Intergovernmental Oceanographic Commission

Training Course Report N° 89

ODINAFRICA:
Marine Biodiversity Data Mobilisation Workshop on Sponges

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1. INTRODUCTION

1.1 ODINAFRICA

The Ocean Data and Information Network for Africa (ODINAFRICA) brings together marine institutions from twenty-five Member States of the Intergovernmental Oceanographic Commission of UNESCO from Africa (Algeria, Angola, Benin, Cameroon, Comoros, Congo, Côte d'Ivoire, Egypt, Gabon, Ghana, Guinea, Kenya, Madagascar, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Senegal, Seychelles, South Africa, United Republic of Tanzania, Togo and Tunisia). The earlier phases of ODINAFRICA enabled the participating Member States to get access to data available in other data centers worldwide, develop skills for manipulation of data and preparation of data and information products, and develop infrastructure for archival, analysis and dissemination of the data and information products.

The goal of the current phase of ODINAFRICA is to improve the management of coastal and marine resources and the environment in participating countries by (1) enhancing data flows into the national oceanographic data and information center in the participating countries; (2) strengthening the capacity of these centers to analyze and interpret the data so as to develop products required for integrated management of the coastal areas of Africa; and (3) increase the delivery of services to end users. The focus is on preparing data and information products to enable the Member States to address the key issues identified in the African Process viz. (i) coastal erosion, (ii) human impacts, (iii) climate change, (iv) pollution, (v) environmental health, (vi) coastal zone (vii) sustainable use of living resources, and (viii) tourism.

The government of Flanders, Belgium has provided US$2.5 million to support the implementation of ODINAFRICA-III phase. The following thematic work packages have been implemented to achieve the objectives of ODINAFRICA-III:

- Coastal Ocean Observing System: focuses on upgrading and expanding African network for in-situ measurements and monitoring of ocean variables (e.g. sea-level, temperature, salinity, currents, winds, etc), provision of near real-time observations of ocean variables, and building adequate capacity for collection, analysis and management of sea-state variables. About 15 tide stations will be installed or upgraded and some of them equipped with sensors for other meteorological and oceanographic parameters.
- Data and Information Management: focuses on further development and strengthening of National Oceanographic Data Centers (NODC) to manage data streams from the coastal ocean observing network, upgrading infrastructure in the NODC's (including internet access and computer systems), integrating biogeographic and hydrological data streams into NODC systems, building capacity for data and information managers for new NODC's established as part of this project and rescue historical data (especially sea level data). The sub-Saharan Africa OBIS node (AfrOBIS; http://afrobis.csir.co.za:8000/) will collate marine biodiversity information from many sub-Saharan African countries. It will upload marine biodiversity data to the main OBIS portal, as well as provide a "local" portal for submission and servicing of data requests. Data will be reformatted, loaded onto AfrOBIS and uploaded to the international OBIS portal at Rutgers.
- Product development and end user communication and information delivery focuses on identification of end users of marine/coastal data/information products and their requirements, identification and development of a set of core products to be prepared by each NODC, development of Regional and National Marine Atlases, improvement of atmospheric and oceanic monitoring databases, promotion and dissemination of outputs of the project to all stakeholders, and assessment of the impacts of products on the end-user.

1.2 Biodiversity

Biodiversity or biological diversity is the diversity of life. This includes plants, animals, fungi and micro-organisms, the genes they contain and the ecosystems they live in. Today, the total number of species on Earth is estimated at about 10 million. New species are often discovered and many of these newly discovered species have not been classified yet. The richest sources of biodiversity are found in rainforests and the oceans. 'Marine biodiversity' refers to this variety of life in sponges, mollusks, fishes, mammals, sea birds, sea turtles, corals reefs, etc…, and the variety of life in the different marine ecosystems such as mangroves, supra-, intra- and intertidal zones, continental shelf and slope, abyssal or deep ocean. Biodiversity has contributed in many ways to the development of human culture, and, in turn, human communities have played a major role in shaping the diversity of nature at the genetic, species, and ecological levels. All species are an integral part of their ecosystem as they perform specific functions that are often essential to their ecosystem and human survival as well. Nevertheless the importance of marine biodiversity for ecological, economical and ethic reasons, there is still a lot of information lacking on the creatures living in this watery environment. In spite of this great lack of knowledge, marine biodiversity is already threatened by various activities. Next to an overexploitation of marine resources, pollution and introducing alien species, there is also a physical alteration of the seafloor through trawling and dredging which has its effect on the present marine fauna and flora.

A number of plants and animals living in the oceans are already being used as a food resource, while sponges for example are now a handy tool in our bathrooms. Not only sponges, but also mangroves have useful applications: they provide tannin for the leather industry and wood for the construction industry. Seaweeds on the other hand do not only naturally temper the beating of the waves during storms; they can also be used as an agricultural soil conditioner or fertilizer. Next to food resources, coastal protection and industrial or agricultural uses, ocean life is also used in biomedical research. Coral reefs for example form a home for thousands of species that may be developed into pharmaceuticals which can help to maintain our health and maybe even treat and cure diseases. But corals can also maintain the sustainability of fisheries resources. Another biomedical example is the exploration of some sponges from the Indo-Pacific for their potential to help produce new drugs. Scientists however fear that many of these little or unexplored resources may disappear before they had the change to tap their potential. In order to better understand the ecosystem functioning and the maintenance of biodiversity in our seas and oceans, it is of great importance to map the present diversity in sea life.

1.3 Sponges

Sponges are ubiquitous and prominent space occupiers and are often the dominant sessile invertebrates found on hard substrata in the marine benthic environment (Bell, 2002). They are sensitive to the quality of the environment, and are among those taxa, which can be used effectively to assess the well being of marine communities and ecosystems (Carballo et al., 1996; 2003; New, 1994). However, ignorance regarding the identity of sponges negates the value of these organisms as useful indicators of environmental health. This is of particular concern along the African coasts owing to the high diversity of sponges there. Sponges also possess a wide range of secondary metabolites, many of which are species-specific. It is known that some of these biochemicals are potentially valuable to the pharmaceutical industry (Hooper et al., 1992), and so should Africa ever be in the position to exploit its sponge resources, it is vitally important that the potential be assessed. Few ecological studies have been conducted on sponges along the African coastline. It is known that sponges may possess algal and bacterial symbionts and so be capable of fixing nitrogen or carbon (Schubauer et al., 1985).

Further, since they can contribute significant amounts of nitrogen through excretion into the surrounding waters, they can be an important source of nutrients to primary producers in nutrient impoverished waters (Schubauer et al., 1985). Apart from this, some chemicals may even be useful indicators of sponge-community interactions (Uriz et al., 1991) and some may also be useful in the taxonomy of the Porifera (e.g. Hooper and van Soest, 2002). Despite their importance, less is known about the taxonomy of African sponges and the features of the environment that determine their distribution than other sub-/tropical sessile invertebrates such as corals and hydroids (Millard, 1975; Williams, 1988). Owing to their relatively variability in form and size, and although chemically (Faulkner, 1998, 2000; Blunt and Munro, 2003; Erpenbeck and van Soest, 2006) and ecologically important (Carballo et al. 1996; Olson & McCarthy, 2005), sponges have attracted less attention than other economically important species such as fish, mollusks and echinoderms, possibly due in part to their difficulty in identification, and paucity of worldwide expertise until recent years.

1.4 Importance of databases

In the old days – before the computer and internet era – all information was written down in books and information was sometimes hard to find. Now, since we have access to computers and the World Wide Web, exchanging information has become a lot easier. However, scientists still do not find it easy to exploit this information because of the variety in for example data formats and interfaces. Therefore, it is very important that data is not just made available, but that it is also managed in a proper way, thus becoming easily accessible and understandable for the user. Databases form the ideal tools to structure information on for example the distribution and taxonomy of species. As a database is not limited to one specific aspect of a species, one can make the available information as broad as possible. One can, for example, include information on taxonomy and distribution, but also on ecological aspects such as life history traits (type of larvae, feeding types …).

A single database can capture all this information, without becoming too complex for its users. One can however not forget that a good biodiversity or taxonomic database needs the input of many internationally respected specialists. Although managing and coordinating these networks and related databases and assisting the participating scientists is very time consuming, it is certainly worthwhile to invest in.

1.5 Taxonomy

During this ODINAFRICA Marine Biodiversity Data Mobilisation Workshop on Sponges, little taxonomic problems were encountered on the broader classification levels (Class, Order, and Family). The higher order classification for this group was based on the Systema Porifera (Hooper and Van Soest, 2002). The encountered problems were most significant at genus or species level or they were related to the cited authority and synonymies.

The most common difficulties were the following:

- The same species being placed under different genera
- Spelling variations in the names of species, genera and families
- Large variation in authorities: different sources give a same authority, but the year of publication varies; authorities placed between brackets in one source, but not in another …
- Genera placed in different families or sub-families, depending on the used source

1.6 Introduction to the represented institutes

Kenya Marine and Fisheries Research Institute – KMFRI

Kenya Marine and Fisheries Research Institute (KMFRI) is a State Corporation in the Ministry of Livestock and Fisheries Development of the Government of Kenya. It is mandated to conduct aquatic research covering all the Kenyan waters and the corresponding riparian areas. The Institute was established by an Act of Parliament (Science and Technology Act, Cap 250 of the Laws of Kenya) in 1979. Its vision is to be a center of excellence for aquatic research and promotion of wise and sustainable use of marine and freshwater resources in Kenya in order to meet the national challenges for food security, poverty alleviation and economic growth. Its mission is to conduct multidisciplinary research in the aquatic systems in both marine and fresh waters in order to generate information for the sustainable management and optimal exploitation of aquatic resources and thus alleviate poverty and enhance employment creation. It is engaged in six programs, namely: fisheries, environment and ecology, information and data management, aquaculture, socio-economics and natural products.

KMFRI is divided into two main research divisions, namely the Inland Waters Research Division based at Kisumu and Marine and Coastal Waters Research Division based at Mombasa. The research center at Kisumu coordinates the following research stations: Kegati, Sangoro, Naivasha, Turkana, Baringo and Nairobi. The research center at Mombasa coordinates the research substations at Gazi and Lamu.

Contact: Kenya Marine and Fisheries Research Institute
P.O. Box 81651, 80100 – Mombasa, Kenya.
Phone: 254 41 475151-4, 475157
Fax: 254 41 475157
Email: kmfri@kmfri.co.ke
Website: http://www.kmfri.co.ke/

National Institute of Fisheries Research - INIP

The National Institute of Fisheries Research (INIP) is a public institution of scientific marine research and fisheries technology. It carries out studies on biological aquatic resources and their respective ecosystems (marine, brackish and fresh water ecosystems) and it also involves in quality control of different fisheries products. The National Institute consists of three departments which are Aquatic resources, Aquatic ecosystems and Fisheries technology. Each department possesses a technical laboratory which in total makes three laboratories. There are also two new laboratories dealing with environmental impacts.

The INIP is involved in different regional as well as international programs such as BENEFIT (Benguela Environment and Fisheries Interaction and Training Program), BCLME (Benguela Large Marine Currents and Ecosystems), GCLME (Guinea Large Marine Currents and Ecosystems), FAO and ODINAFRICA.

Contact: Instituto Nacional de Investigaçõa Pesqueira
National Institute of Fisheries Research
Email: iim@angola-minpescas.com
Website: http://www.angola-minpescas.com/IIM/index.aspx

Nigerian Institute for Oceanography and Marine Research (NIOMR)

The Nigerian Institute for Oceanography and Marine Research (NIOMR) was established out of the research Division of the Federal Department of Fisheries in November 1975 to conduct research into the resources and physical characteristics of the Nigerian territorial waters, exclusive economic zone and the high seas beyond. The research mandates of the Institute have been formulated to meet the following national needs for research and technical development in matters within the purview of the institute:

- Genetic improvement of marine and brackish waters fisheries and other aquatic resources
- The abundance, distribution and other biological characteristics of species of fish and other marine form of life and practical method of their rational exploitation and utilization
- The socio-economic problems of exploitation of the resources of the sea and brackish water
- The effect of pollution on Nigerian coastal waters and its prevention improvement of brackish water fishing and fish culture;
- design and fabrication of simple fisheries implements and equipment
- the nature of marine environment including weather forecasting and topography of the seabed and deposits on or under the seabed

Contact: Nigerian Institute for Oceanographic and Marine Research
Victoria Island Lagos
Nigeria, P.M.B. 12729
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Council for Scientific and Industrial Research (CSIR)

The CSIR was founded on 5 October 1945 (Scientific Research Council Act, Act 33 of 1945) and was constituted as a science council by the Scientific Research Council Act (Act 46 of 1988, as amended by Act 71 of 1990). The organisation is also listed as a public entity in terms of the Public Finance Management Act, Act 1 of 1999, as amended by Act 29 of 1999. The organisation undertakes and applies directed research and innovation in science and technology to improve the quality of life of the country's people. Building measurable value into its work through local and international partnerships remains a key component of its endeavours to provide world-class technology.

The CSIR's mandate is as stipulated in the Scientific Research Council Act (Act 46 of 1988, as amended by Act 71 of 1990), section 3:

"The objects of the CSIR are, through directed and particularly multi-disciplinary research and technological innovation, to foster, in the national interest and in fields which in its opinion should receive preference, industrial and scientific development, either by itself or in co-operation with principals from the private or public sectors, and thereby to contribute to the improvement of the quality of life of the people of the Republic, and to perform any other functions that may be assigned to the CSIR by or under this Act."

The R&D core: operating units that draw together skills from research fields and scientific disciplines to address national S&T needs. The CSIR operating units are:

- Biosciences
- Built Environment
- Defence, Peace, Safety and Security
- Materials Science and Manufacturing
- Natural Resources and the Environment

Natural Resources and Environment: Pollution and Waste

Research into pollution and waste is undertaken in view of the impact of increasing populations and a strong national focus on industrial, agricultural and urban growth that is likely to result in the increase of human-induced pressures on the environment. Despite the implementation of policy to ensure the reduction and mitigation of pollution, there will be an ongoing need to deal with waste products (whether in their solid, liquid or gaseous form). The key components of the pollution and waste research hierarchy and their interrelationships, as well as a number of broader integrating research areas, can be found on http://www.csir.co.za/plsql/ptl0002/PTL0002_PGE132_BUS_AREA?DIVISION_NO=7318422&BUSINESS_AREA_NO=7355052

Coastal and Marine Pollution

Effluents and pollutants are characterised in terms of their physico-chemical constituents and ecological effects. Research is conducted on the fate of pollutants in coastal environments; their dispersion, distribution, persistence and breakdown products, as well as their effect on coastal resources. Causal relationships between pollutants and ecological processes are investigated and expertise in the design and implementation of chemical and biological monitoring programmes is developed for applied use by both the private and public sectors. Pollution assessments in marine and estuarine ecosystems are conducted at local, regional, national and international scales.

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2. MATERIALS

2.1. Aphia

Reference: www.vliz.be/vmdcdata/aphia

VLIZ is currently doing several projects involving taxonomic names and biogeographical information. To make sure that the taxonomy used in these different projects is consistent, a separate database supporting these different activities was developed. Aphia, the resulting species register, is complemented with extra information like distribution records, vernacular names and photographs.

Detailed sources of taxonomic information are an integral part of the database, and are listed in the web interface with the information on individual taxa. For the classification, a number of standard works have been chosen, and these choices are also documented in the database. It should be noted that the classification used is, by necessity in a database with such wide taxonomic scope, a 'compromise' classification, and that it is very difficult to be completely up-to-date for all taxonomic groups.

The database structure includes fields for the following information:

- Taxon name, rank and parent (required fields)
- Source used to create record (required field); can be person (expert), database or
- Publication
- Authority of the taxonomic name (optional); including authority for new combination for botany; including any 'non', 'ex', ... clauses as needed
- Original publication (optional); publication in which the taxonomic description was originally published
- Type taxon (optional); for families and genera
- Currently accepted taxon (required field); by default points at the taxon itself
- Actual (required for taxa placed in synonymy) and primary source (optional) for the
- Synonymy

There is a provision to make annotations - these are dated and attributed to one of the possible information sources (expert, database or publication). Other tables allow storing vernacular names (in several languages), and distribution records. Since Aphia is a single database supporting different projects and web sites, there has to be a mechanism to assign information to these contexts. The database should, in fact, be seen as a collection of overlapping subsets of data, where each piece of information can be selectively shown in one or several contexts. Thus, a sponge species occurring in Europe will be visible to a visitor of the European Register of Marine Species, but the same record will be shown to a visitor of Porifera, a web site with a world-wide list of sponges. The most important projects incorporated in Aphia are

- European Register of Marine Species (ERMS)
- Porifera
- Cumacea
- Register of Antarctic Marine Species (RAMS)
- North West Atlantic Register of Marine Species (NWARMS)

Most importantly, it is used to standardise all taxonomic names of the biogeographical records. The two main collections of biogeographical records are the European node of the Ocean Biogeographical Information System (EurOBIS – now also including the Taxonomic Information System on the Belgian coastal area, TISBE), and the Antarctic node of OBIS, SCAR-MarBIN.

2.2 VLIMAR Gazetteer

Reference: www.vliz.be/vmdcdata/vlimar

The VLIMAR gazetteer is a hierarchical list of geographical place names. As it is a marine gazetteer, it is focused on names of sandbanks, bays, gulfs, seas, islands, seamounts, coastal regions, ridges, bays and standard sampling stations used in marine research. The geographic cover of the gazetteer is global; however the gazetteer is focused on the Belgian North Sea Region, the Scheldt estuary and the Southern Bight of the North Sea. The purpose of the gazetteer is to improve access and clarity of the different geographic, mainly marine names used in marine research. The gazetteer is consultable through a web interface (http://www.vliz.be/vmdcdata/vlimar) where one can search and browse through the database.

Each geographical place name has a certain place type and can be linked with a certain relation type ('part of', 'adjacent to',…) to one or more other place types. Angola, for example, has a place type 'Nation' and is part of Africa. Bay of Mussulo has a place type 'Bay' and is part of the South Atlantic Ocean. Furthermore, it is linked with Luanda, a region that is part of Angola, with the 'adjacent to'-relation.

Place names can also be linked with geo-units of other databases like Aphia. This link, in combination with the relations between the place names, makes it possible to do some complex biogeographical queries. This way, species that were found in the Bay of Mussulo can be included in the species list of Luanda, the species list of Angola, the species list of Africa, the species list of the South Atlantic Ocean, etc. Place names are also linked with geographical locations. This can be centroïd coordinates of the place name but it can also be polygons or polylines that describe the shape of the place name. This makes it possible to show the exact location of place names on an interactive map.

2.3 Sources used to enter data into the database

The following sources (books, articles and internet) were used to enter species into the database and/or to check if the taxonomy was correct. All these sources are seen as reliable sources for taxonomic information. If there was any doubt about the taxonomy or if there were differences among sources, priority was given to the book 'Systema Porifera" edited by Hooper and Van Soest (2002).

Sponge Classification

Full reference: Hooper, J.N.A & Van Soest, R.W.M. (eds) 2002. *Systema Porifera, a guide to the classification of the sponges* (in 2 volumes). Kluwer Academic / Plenum Publishers, New York: 1-1708, i-xlviii

This book gives an overview of all Porifera classifications. Continued research in the field of sponges has led to new taxa being discovered and the general classification developing due to changes and additions. It is a book that revises and stabilises the systematics of the phylum to accommodate this new knowledge in a contemporary framework. Practical tools (key illustrations, descriptions of character) are provided to facilitate the assignment of

approximately 680 extant and 100 fossil genera. *Systema Porifera* is unique making sponge taxonomy widely available at the practical level of classification (genera, families, order). It is a taxonomic revision of sponges and spongiomorphis (such as sphinctozoans and archaeocyathans) based on re-evaluation of type materials and evidence. It is also a practical guide to sponge identification providing descriptions and illustrations of characters and interpretation of their importance to systematics. *Systema Porifera* addresses many long standing nomenclatural problems and provides a sound baseline for future debate on sponges and their place in time and space. Sponges are among the most highly diverse and successful of the aquatic invertebrate phyla, with about 7 000 described species and at least twice this number extant worldwide. They are an ancient group, largely unchanged in their body plans since the late Cambrian. Once an important reef-building phylum they have radiated and diversified and are found in all aquatic habitats today. They are economically as well as ecologically important being primary targets for marine natural products and pharmaceutical research and consequently our knowledge of sponge biodiversity have increased substantially over recent decades.

The *Systema Porifera* describes 3 classes, 7 subclasses, 24 orders, 127 families and 682 valid genera of extant sponges (with over 1600 nominal generic names and an additional 500 invalid names treated). Treatment of the fossil fauna is less comprehensive or critical, although 6 classes, 30 orders, 245 families and 998 fossil genera are mentioned. Keys to all recent and many fossil taxa are provided.

Systema Porifera Database

Reference: http://www.vliz.be/vmdcdata/porifera/

As a result of long term accumulation of literature records of extant sponges by Rob van Soest and John Hooper, we can now for the first time present a searchable preliminary world database of all recent sponges ever described. The list is a logical follow up and addition to the *Systema Porifera* (editors Hooper & Van Soest, 2002). The list is intended to promote stability and act as a tool for higher taxon revisions, regional monographs, and eventually as a catalogue of the world's sponge specimen databases as these are slowly being accumulated through EurOBIS and GBIF. In order to have sufficient expert knowledge an editorial committee consisting of:

- Dr Rob van Soest, general list editor
- Dr Nicole Boury-Esnault, editor for Calcarea
- Dr Dorte Janussen, editor for Hexactinellida
- Dr John Hooper, editor for Demospongiae

Marine Species Database for Eastern Africa - MASDEA

Reference: www.vliz.be/vmdcdata/Masdea/

The Marine Species Database for Eastern Africa (MASDEA) was conceived to fill the need for a comprehensive species register for the western Indian Ocean. The database was created to enter all species records from the western Indian Ocean that was published in peer refereed publications. The database thus includes a species register for the region and a road map to the scientific literature relevant to biogeographical studies in the region. Further information on this database can be found in annex II.

Two Oceans: a guide to the Marine Life of Southern Africa

Full reference: Branch, G.M., Griffiths, C.L., Branch M.L. & Beckley, L.E., 2002. Two Oceans. A guide to the marine life of Southern Africa. D. Philip Publishers, Cape Town. Revised 5th Impression, 360 pp. ISBN 0-86486-250-4

This book gives an overview of the data capture for Southern Africa (i.e. South Africa, Mozambique and Namibia). In addition to the geographical range of the occurrence of the species, the book also provides a number of pictures.

Literature used to enter sponge data for Africa (during the workshop):

- Branch, G.M. et al. 2002. *Two Oceans*. 5th impression. David Philip, Cape Town & Johannesburg.
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- Rios, P. & and Cristobo, J. 2006. A new species of *Biemna* (Porifera: Poecilosclerida) from Antarctica: Biemna strongylota. *Journal of the Marine Biological Association, United Kingdom*, 86, 949-955.
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3. LITERATURE STUDY (by Toufiek Samaai)

3.1 Overview of South African Sponges

Since Esper (1797) described some sponges from the Cape of Good Hope, there have only been a few expeditions or collections from this district. These include reports by Carter (1876, 1879, 1881, and 1883), Vosmaer (1880), Ridley and Dendy (1887), Kirkpatrick (1902, 1903), Baer (1905), Stephens (1915) and Burton (1926, 1931, 1933, 1936). More recently, Lévi examined some material belonging to the orders Poecilosclerida (1963) and Astrophorida (1967) (Class Demospongiae), while Borojevic (1967) looked at some Calcarea, and Uriz (1984, 1985, 1988) investigated some Namibian sponges. Day (1974) provided the first species list and ecological notes for sponges in the False Bay region of South Africa.

Sponge studies in the late 1800's and early 1900's focused primarily on the deep-water fauna of the south and east coasts of South Africa. Although the lists that were compiled were comprehensive at the time, there were no detailed descriptions of the species were provided. In the 40 year odd years from 1847 to 1887, Carter published no less than 125 papers on sponges, including species found around South Africa, a far greater number than any other author. These papers treated nearly 800 distinct species in 200 distinct genera. The greater portions by far of these works by Carter were purely systematic, but he has also contributed vastly to the understanding on the anatomy and embryology of this group.

Vosmaer (1880) completed two volumes on sponge taxonomy, and named some 70 species. The material he examined came from the Leyden Museum of Natural History, which contained species collected from the Cape of Good Hope, and other areas in the Atlantic Ocean: *Amphilectus caesper*, *Desmacidon (Myxilla?) elastica* and *Clathria lobata* from the Cape of Good Hope; *Chondrochealia virgata, Esperia conlaremii* and *Clathria anchorata* from the Atlantic Ocean and *Clathria pena* from west Africa.

Ridley and Dendy (1887) made their collections during the "Challenger" Expedition. In their volume, they described 54 genera and approximately 100 species. Although many of the species they described were from the Pacific and Indo-Pacific Oceans, as well as from Antarctica, they nevertheless made a valuable contribution to our knowledge of the South African sponge fauna. They described ten species from South Africa: *Raspailia flagelliformis*, *Raspailia rigida*, *Clathria Lobata*, *Coelosphaera navicelligerum*, *Desmacidon ramosa*, *Lissodendoryx digitata*, *Isodictya conulosa*, *Isodictya grandis* and one species belonging to the genus *Haliclona*. Baer (1905) provided a list of 24 species from Zanzibar, which also included some species found off the Cape of Good Hope, and of these only one had also been reported by Ridley and Dendy (1887).

Kirkpatrick's (1902, 1903) reports on the "Gilchrist" collection provide the most complete account of South African sponges. Kirkpatrick's collection comprised approximately 50 species (28 new species) of which the bulk was collected on the eastern boundaries (Natal

coast) of South Africa. A Comparison of Kirkpatrick's collection to those of both Ridley and Dendy (1887) and Carter (1876, 1879, 1881, 1883, 1885), indicate only six species in common. These include *Tetilla casula* Carter, *Clathria typica* Carter, *Higginsia bidentifera* Ridley and Dendy, *Desmacidon ramosum* Ridley and Dendy, *Desmacidon grande* Ridley and Dendy, and *Hamacantha esperioides* Ridley and Dendy.

The collection of sponges made by Stephens (1915) ("Scotia" Expedition) during an ecological survey from False Bay to Saldanha Bay on the west coast, contained 37 new species, and expanded the range for a number of other species that had previously been recorded locally. This collection, although small, contributed much to the knowledge of the South African west coast sponges, because it was confined to a short stretch of coastline. A comparison of Stephens' collection to that of Kirkpatrick reveals not a single species in common, although five genera were the same. This might be due to the fact that the "Gilchrist sponges" (Kirkpatrick, 1902-03) were taken over a shorter period of time in South African waters and in deeper waters than the sponges collected by the "Scotia" expedition (Stephens, 1915).

All these expeditions collected large quantities of sponges, and many of the new species that were described for the west coast were not found on the Natal Coast (Lévi, 1963). In total, the "Gilchrist" (Kirkpatrick, 1902-03), "Challenger" (Ridley and Dendy, 1887) and "Scotia" expeditions (Stephens, 1915) collected a total of 180 Demospongiae, 16 Calcarea and 6 Hexactinellida sponges (Lévi, 1963) from around South Africa.

Burton initiated a survey to collect sponges along the South African west coast during the period 1926-1936. He wrote various reports that focused on particular orders' and was the first to survey lithistid sponges. In his 1926 publication, Burton described 21 species of "Myxospongida" and "Astrotetraxonida" and also included descriptions or reports of specimens from the British, Natal and Durban museums, as well as from Professor Dendy's Port Phillip (South Australia) collection. Although Burton also made an extensive collection of the sponge fauna from the Atlantic seaboard of the African continent during the Danish Expedition (1945-1946), this does not include South Africa. The total number of species recorded in this report, from the central west African coast was 65, of which nine were endemic to tropical West Africa, and five were new species. Previously, he had recorded 23 species on the Atlantic seaboard of Europe and by comparing the one to the other he concluded that half the species recorded from tropical West Africa occurred also in the Mediterranean. These species included *Leuconia rudifera* Polèjaeff, *Tethya aurantium* Pallas, *Suberites carnosus* (Johnston), *Haliclona angulata* (Bowerbank) and *Myxilla rosacea* (Lieberkühn). He also noted that some more northerly species were also to be found off West Africa.

The most recent, and comprehensive, works covering South African sponges are those of Lévi on the order Poecilosclerida (1963) and the order Astrophorida (1967) (Class Demospongiae), and by Borojevic (1967) on the class Calcarea. Having said that, most of the coastal species were collected along the east coast.

Uriz (1984, 1985, 1988) on the other hand, focused her attention on the Namibian deep-water sponge fauna, or more generally that between 04° and 29° S off West Africa. Still, in view of the geographical proximity and depth of the waters considered in these works (including Lévi, 1963), they were taken as the initial references for the study of the sponge fauna along the west coast of South Africa. It is also in need of revision because methodological approaches to sponge taxonomy have changed quite substantially since the turn of the 20th century.

While the above works gives us some information, there is a lack of comprehensive local collections that can be used reliably for identification. We have recently embarked on extensive regional and local collections to address the lack of knowledge of our sponge biodiversity (Samaai, 2002; Samaai et al., 2004; Samaai and Gibbons, 2005). The first comprehensive taxonomic study on sponges in South Africa, since the first expeditions, was

carried out along the West Coast by Samaai and Gibbons (2005); these efforts have subsequently been extended to include the east coast. Prior to these studies, the number of described sponges from South Africa (ranging from Oranjemund on the West Coast to Richards Bay on the East Coast), totaled 298 species (from the literature). Since these studies, 27 new species have been described for South Africa (Samaai and Gibbons, 2005; Samaai *et al*., 2003; Samaai *et al*., 2004a&b, Samaai *et al*., 2004), with new species being discovered at an increasing rate on the East Coast (unpublished data). Thus currently there are 314 nominal species of sponges known from South Africa, but only a small percentage of these come from the subtidal regions of the East and south coasts of South Africa (Samaai, 2002; Samaai et al., 2003, 2004; Samaai and Gibbons, 2005).

3.2 Overview of sponges of the Western Indian Ocean

An extensive literature (see reference list) overview on sponges of the western Indian Ocean is provided in Hooper et al., 2002. In this paper, Hooper et al (2002) describes a new species of *Clathria* and compares it with the other 64 species of *Clathria* described from the Western Indian Ocean, South Africa and the Arabian Gulf-Red Sea provinces. The extensive literature list that is provided in this paper contains 'several hundred' species (Hooper et al., 2002), but this is undoubtedly far from complete. This paper also provided biogeographical and comparative overview of sponges within the Western Indian Ocean region.

On the other hand, Von Lendenfeld, R. (1897), was the first to describe sponges from Zanzibar and provided a list of 22 species distributed within the Western Indian and Pacific Oceans. In this paper he also provided 38 distribution records for the 22 described species.

In an ecological paper by Barnes & Bell (2002) they described the affinities, richness and diversity patterns of 98 sponge species found within the coastal communities [such as Malindi (Kenya), Quirimba Archipelago (N. Mozambique), Inhaca Island (S. Mozambique) and Anakao (SW Madagascar)] within the West Indian Ocean. In this paper they also provided 209 distribution records of the 98 species recorded.

Thomas contributed vastly to our knowledge of sponges distribution pattern of the Western Indian Ocean and there affinities to the Pacific Ocean, Red Sea and the Mediterranean. In his 1973 publication Thomas described 127 sponge species from Mahe islands off the Seychelles Bank (Indian Ocean). In his 1979 publication Thomas described 59 sponge species with no less than 217 distribution records from Inhaca Island in the Mozambique Channel. His descriptions were based on material collected from three different centres along the coast of Mozambique during 1965 by Prof J Bouillon, Universte Libre de Bruxelles, Belgium. Most specimens came from Inhaca Island but some came from mambone and paradise islands. Throughout the latter years Thomas published a second paper on sponges from the Seychelles (1981). In this paper he described 73 species.

3.3 Overview of sponges of Tropical West Africa

Van Soest, R.W.M., 1988 described a new species of *Tetrapocillon* (*Tetrapocillon atlanticus*) from the Cape Verde islands. He also provides a comparison with species from the Indo-Pacific and provides an overview on the affinities between the genus Tetrapocillon and other genera, such as *Guitarra* and *Coelodischela*, seemingly related on the basis of similarities in the microsclere complement.

Van Soest (1990) described a new species of *Monanchora stocki* from the Mid-Atlantic Islands. He also provides a comparison with species from the other regions and provides a comparison between different species within the genus *Monanchora.* He also makes

reference to 8 valid species with various distribution patterns within the Atlantic, pacific and Mediterranean Sea.

Van Soest (1993) in a paper describing the distribution of Mauritanian continental sponges provided a list of 7 species with 13 different distributions. This was an ecological study on the continental shelf off the Banc d'Anguin, Mauritania, which revealed a patchy distribution of sponge species and populations. Horizontal distribution of the sponges shows a distinct gap in species and numbers associated with muddy bottom area where the sediment rich Banc d'Anguin run-off is found. This muddy are forms the barrier between very different sponge faunas between the North and South.

Burton (1956) described sponges from West Africa (see above on South African Sponges). In this paper he makes reference to 186 from West Africa. This is a list off species recorded form the west central African coast 9 are endemic, with 5 new reports. Some of this species have previously been reported in Europe and the Mediterranean. This report also shows that there is a much in common between the sponge faunas of the West African region and the Mediterranean but elements of the more northerly species are also found off West Africa

In this paper, van Soest (1993) provides a list of aaffinities of the Marine Demospongiae Fauna of the Cape Verde Islands and Tropical West Africa. His species list comprised of 99 species with over 526 distributions.

3.4 Overview of other African Countries

Mustapha et al., 2003 described 96 species from Tunisia. However, these sponges have a greater affinity with the Mediterranean sponge fauna than with Africa .

An expedition done in 1962 by Israel and described by Lévi (1965). provided a list of 45 species for the Red Sea area. Most of the species we not restricted to the Red Sea, with distributions stretching from the Mediterranean Sea to the Pacific Ocean. Lévi recorded no more than 144 distributions for the described species.

Maldonado (1992) described some 58 (after examining a total of 107) sponges species from the Alborean Sea with 61 apparent distributions recorded for the sponges from that region. Two of these species are new to science (*Plakinastrella mixta* sp. nov. and *Leptolabis megachela* sp. nov.) and another one (*Rhaphidectyon spinosum* Topsent) is recorded for the first time in the Mediterranean. Some other specimens collected belonging to poorly known species, such as *Erylus papulifer* Pulitzer-Finali, *Isops anceps* (Vosmaer), *Spongosorites flavens* Pulitzer-Finali and *Timea cumana* Pulitzer-Finali, are described briefly. Two controversial specimens, assigned to *Microciona spinarcus* and *Plocamilla cf. novizelanica,* are also described and discussed. A high degree of epibiosis and abundance of rare species were the major features characterizing the material studied.

Ilan et al., (2004) describes six new species in the northern Red Sea while some were reassigned and renamed to avoid homonymy with others.

Perez, et al., 2004 described two new lithistids (Porifera: Demospongiae) from a shallow eastern Mediterranean cave off the coast of Lebanon. They also make reference to 7 species and describe 8 distribution patterns.

Voultsiadou, & Vafidis (2004) described some rare sponge (Porifera: Demospongiae) species from the Mediterranean Sea. In spite of the Mediterranean Sea sponges, being widely studied, the knowledge of the eastern basin sponges is still wanting. This publication looks at rare sponges discovered in the Aegean Sea and descriptions and distribution of some poorly known sponges was discussed.

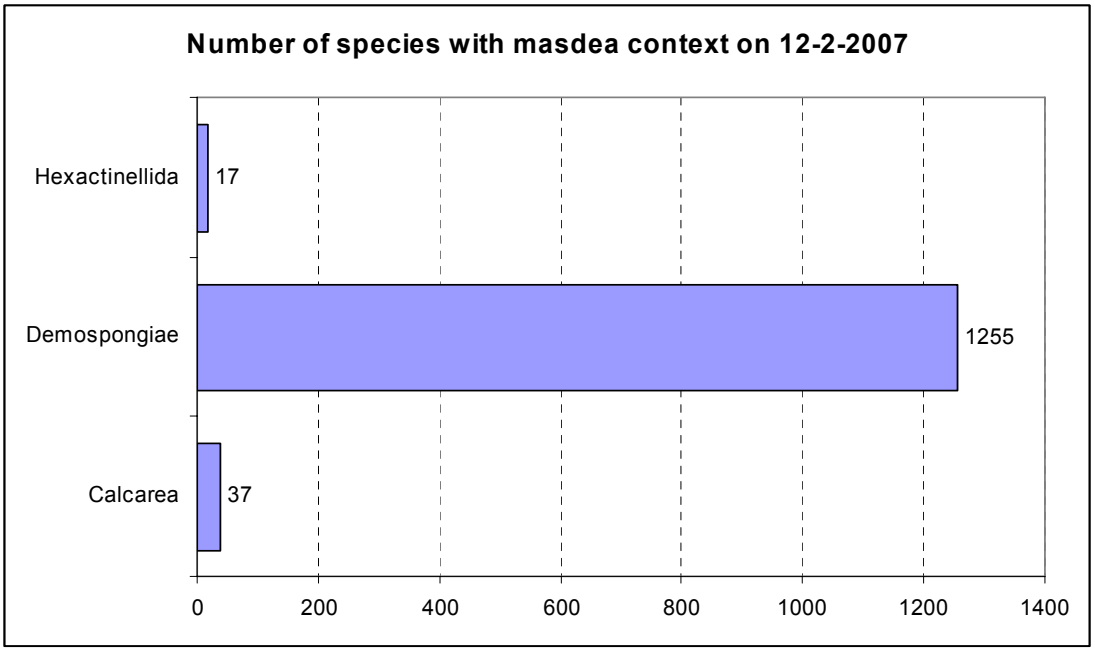
4. RESULTS

4.1 General

At present, 1 883 taxa belonging to the Phylum Porifera have been entered into the aphia database, with a “masdea” context, representing 1 309 known species and subspecies from around the world. The majority of these species belong to the class Demospongiae (1 255 species or 95,87 %), with the remaining species belonging to the classes Calcarea (37 or 2,83 %) and Hexactinellida (17 or 1,3 %).

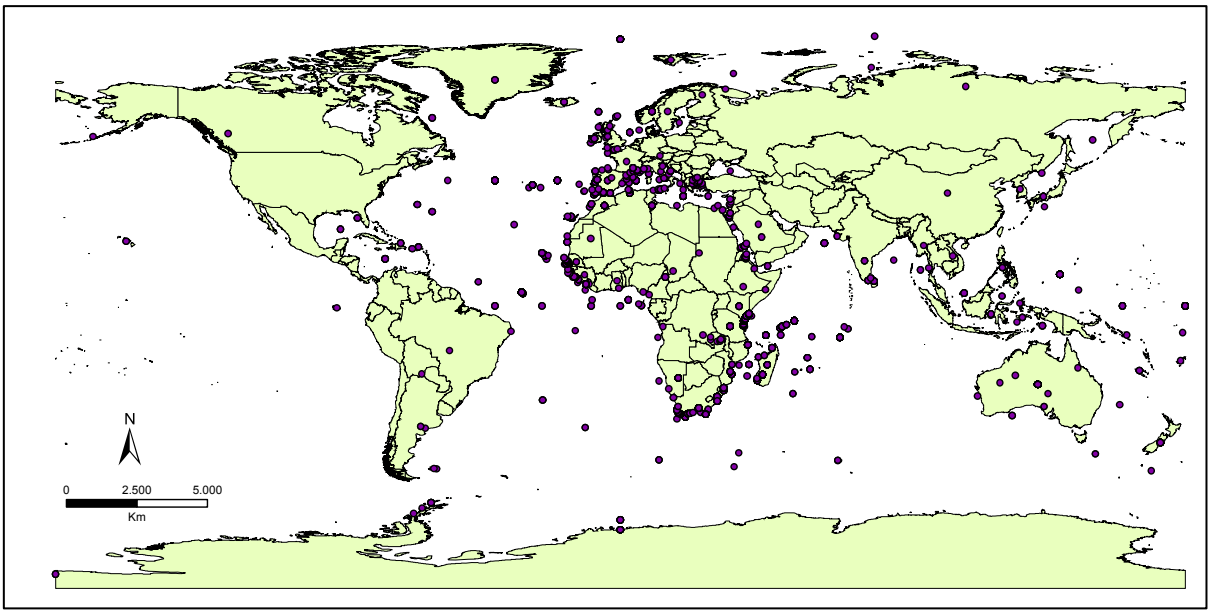
When considering all know species within the database (1 883), only 40 species (2,12%) contain no information on authority or year of publication. Apart from this 1/3 (570) of the taxa within the database were considered to be invalid or synonyms. During the sponge data mobilization workshop, 199 sponge taxa were added to the database with a further 415 taxa extending there distribution patterns in Africa.

All the information added during this workshop was extracted from over 60 different sources (books & articles).

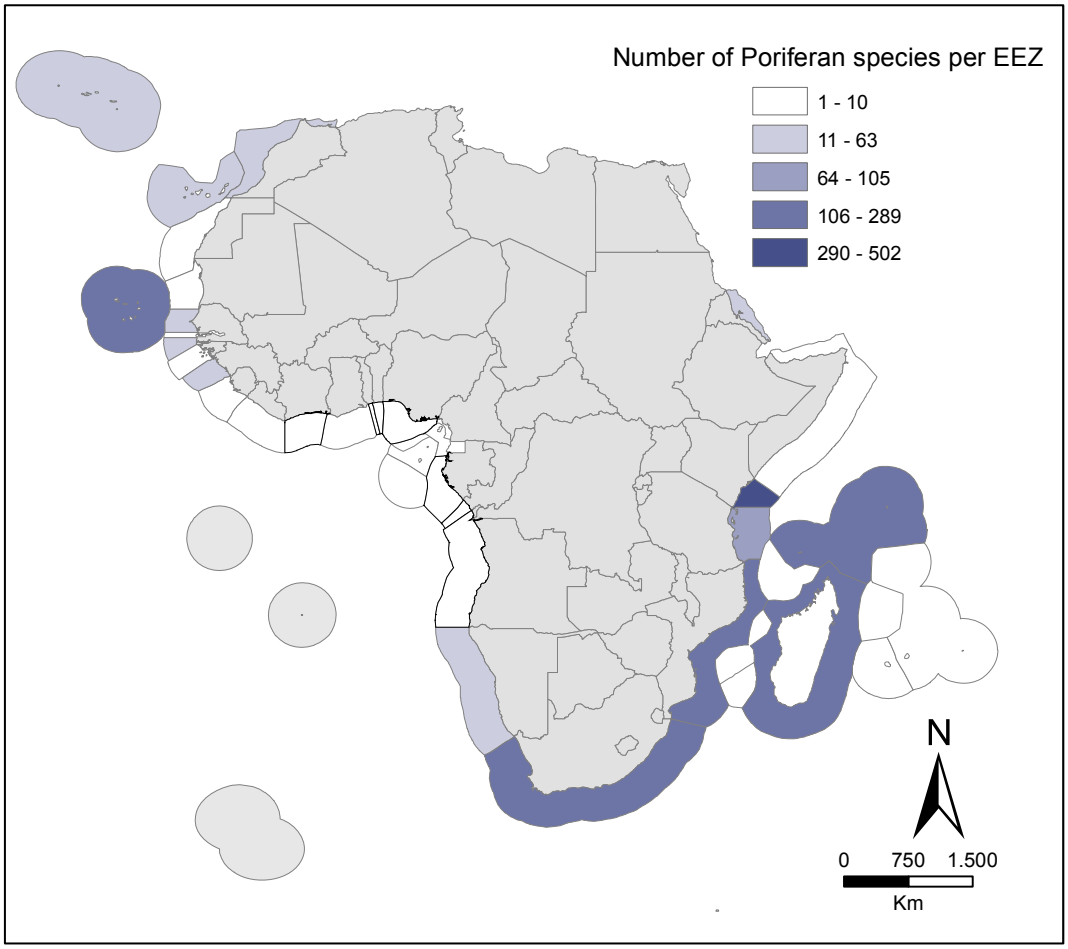


4.2 Geographical

As seen on this general distribution map, species with an African context are not confined to Africa, but are widespread, extending as far as Australia in the west or North-South America to the east. Inland distributions are renced species occurring in rivers, lakes or estuaries, or they represent taxa with a broader distribution range. E.g. a marine taxon found in Angola is likely to have been found along the coast, but – for practical reasons – the coordinates assigned to Angola are the coordinates of the centre of this province.



General map, representing the distribution of all poriferan species with a Masdea-context (dots on map)



Number and distribution of poriferan species in the African EEZs

For the African continent, at present 1307 poriferan taxa have been recorded from the East Africa region, 538 from west Africa and 318 from South Africa. Within Africa the highest number of species was recorded from the Western Indian Ocean with the highest number of sponge taxa recorded from Kenya (502), the province of South Africa (230) and the Seychelles (235).

A number of taxa having broad distribution ranges (e.g. Atlantic Ocean, Indian Ocean and West-Africa) were excluded from the above analysis. However, all distributional ranges were included in the comparative analysis below:

- Taxa found in both East-Africa and West-Africa: 21
- Taxa found in both South-Africa and West-Africa: 15
- Taxa found in both East-Africa and South-Africa: 26
- Taxa found in South-, East- and West-Africa: 4

5. DISCUSSION

5.1 Analysis

Before we discuss the results, the reader should be aware of the fact that our database shows incompleteness on two levels. First of all, not all data sources concerning African marine Porifera have been entered into the database. Secondly, publications on marine sponge biodiversity in Africa only represent a limited reproduction of the actual number of marine sponge species present in the region. This first 'incompleteness' can be overruled by actively searching for more publications on African marine sponges (also see further) so that the database can become more and more complete. The second problem however is out of our league, although it can be very useful as gap-analysis: it can show researchers which information is still lacking and maybe it can stimulate them to fill these gaps.

The results shows that many of the published poriferan species described from Africa have been documented in the database. For many of the species, multiple distribution locations are known, which enables one to compare percentage similarity patterns between genera in selected regions of countries (e.g. Europe vs. Africa; East Africa vs. West Africa, …). These comparisons may indicate whether certain locations or regions are undersampled, whether certain areas have a richer diversity patterns than others, or whether certain species are endemic or cosmopolitan.

For example, from the analysis, it is evident that higher numbers of sponge taxa are founf within the western Indian Ocean region as oppose to tropical west Africa. From this, one can possibly conclude that the countries with low poriferan diversity should perhaps get a priority treatment when looking for more data for the database. Having a low number of species in the EEZ does not necessarily mean that there are no species present; it is merely an indication of the efforts that have been made to document the presence of marine sponge species in those areas or countries.

5.2 How do we deal with conflicts?

During the input of Poriferan species into the database, several 'imperfections' were found.

- For some records, two sources were mentioned as “basis of record”, which is not possible. One should look up both sources again and find out which one formed the basis of the record. The other source then becomes an “additional source”.
- The used sources do not always mention an exact geographical distribution. This makes it difficult to fill in a distribution record. When the distribution is very broad (e.g. Atlantic, circumtropical or Africa), it becomes rather difficult to represent this on a graph or a map, since the reader can interpret it in various ways.

There were also some problems with the used sources. The same taxon can be mentioned in different sources, but which source should then be considered as the “basis of record”? if variation in spelling, authority, year of publication and synonymy appeared, which source should then be seen as the correct one? For these and similar problems, we turned to the following solutions:

- Check of literature by Dr. Toufiek Samaai. As a poriferan taxonomist, Dr. Samaai was able to distinguish between reliable and less reliable sources.
- Contact with the taxonomic editor of Porifera: dr. Rob van Soest. Dr. van Soest has been available through email for questions and corrections during the entire workshop
- Check if the name was already available in the poriferan database (based on the book *Systema Porifera*). If so, the spelling / authority / … mentioned in *Systema Porifera* was followed.

6. GENERAL CONCLUSION

During the workshop, a large number of species have been entered into the database. All species were extracted from (monographic) literature and articles at our disposal. A lot of sources on African marine sponges are present at the VLIZ-library; other sources were introduced by the participants themselves. An overview of the present sources at VLIZ and other literature concerning African poriferans are given in the annex “Monographic literature on African marine Sponges”.

There is likely still a lot more data on African marine sponges available in grey reports, laying on dusty shelfs, which are in danger of getting lost. An effort should be made to also rescue these historical data and to integrate them together with the more easily accessible data published in current scientific journals. This way, a complete inventory of what lives and lived along the African coastline can be made. In this workshop, we have made the first steps towards such an African species register of Marine Sponges.

Further completing the database will be necessary to stay up to date with the available literature and existing species.

7. PARTICIPANTS

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ANNEX I

Monographic literature on African marine Sponges, available in VLIZ Library

Branch, G.M. *et al.* 1994. Two oceans: a guide to the marine life of southern Africa. D. Philip: Cape Town, South Africa. ISBN 0-86486-250-4. 360, photographs pp.

Bourmaud, C.A.F. *et al.* 2005. Coastal and marine biodiversity of La Réunion. *Indian J. Mar. Sci. 34(1)*: 98-103.

Boury-Esnault, N. 1987. The *Polymastia* species (Demosponges, Hadromerida) of the Atlantic area, *in*: Vacelet, J.; Boury-Esnault, N. (Ed.) (1987). *Taxonomy of Porifera from the N.E. Atlantic and Mediterranean Sea. NATO ASI Series G: Ecological sciences,* 13: pp. 29-66.

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ANNEX 2

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ANNEX 3

Available Databases

- Kenyan, and South African country lists (Excel sheets)
- MASDEA (Access MDB; integrated in database; needs checking/integration of taxonomy)
- Aphia
- Systema Porifera on Web

ANNEX 4

Available through the web

- Nomenclator Zoologicus (http://www.ubio.org/NomenclatorZoologicus/)
- ITIS - Integrated Taxonomic Information System: http://www.itis.usda.gov/
- Species 2000 (http://www.sp2000.org/)
- CIESM – The Mediterranean Science Commission (http://www.ciesm.org/online/atlas/index.htm)

ANNEX 5

Referral systems/abstracting services

Aquatic Sciences and Fisheries Abstracts – ASFA - on Cd or on-line (www.csa.com, you need a password to enter the online database). Aquatic Sciences and Fisheries Abstracts (ASFA) is an International Cooperative Information System which comprises an abstracting and indexing service covering the world's literature on the science, technology, management, and conservation of marine, brackish water, and freshwater resources and environments, including their socio-economic and legal aspects.

Oceanic Abstracts (www.csa.com/factsheets/oceanic-set-c.php). Oceanic Abstracts is focused exclusively on worldwide technical literature pertaining to the marine and brackish-water environment. The database has long been recognized as a leading source of information on topics relating to oceans. The database focuses on marine biology and physical oceanography, fisheries, aquaculture, non-living resources, meteorology and geology, plus environmental, technological and legislative topics.

IOC Training Course Reports

No.	Title	Language
1.	IOC Indian Ocean Region Training Course in Petroleum Monitoring Perth, 18 February-1 March 1980	English
2.	IOC Regional Training Course for Marine Science, Technicians Cape Ferguson, Queensland, 1-28 June 1980	English
3.	ROPME-IOC-UNEP Training Workshop on Oceanographic Sampling Analysis, Data handling and Care of Equipment, Doha, Qatar, 3-15 December 1983	English
4.	Stage COI d'initiation à la gestion et au traitement de l'information scientifique et technique pour l'océanologie, Brest, France, 28 novembre - 9 décembre 1983	French
5.	Curso mixto COI-OMM de formación sobre el Sistema Global Integrado de Servicios Oceánicos (SGISO), Buenos Aires, Argentina, 15-26 de octubre de 1984	Spanish
6.	UNESCO-IOC-NBO Training Course on Tidal Observations and Data Processing Tianjin, China, 27 August - 22 September 1984	English
7.	Stage COI sur la connaissance et la gestion de la zone côtière et du proche plateau continental Talence, France, 18 septembre - 4 octobre 1984	French
8.	IOC Regional Training Course on Marine Living Resources in the Western Indian Ocean Mombasa, Kenya, 27 August - 22 September 1984	English
9	IOC-UNESCO Summer School on Oceanographic Data, Collection and Management Erdemli, Icel, Turkey, 21 September - 3 October 1987	English
10.	IOC-UNESCO Regional Training Workshop on Ocean Engineering and its Interface with Ocean Sciences in the Indian Ocean Region Madras, India, 17 March - 5 April 1986	English
11.	IOC-UNESCO Training Course on the Use of Microcomputers for Oceanographic Data Management Bangkok, Thailand, 16 January - 3 February 1989	English
12.	IOC Advanced Training Course on Continental Shelf Structures Sediments and Mineral Resources Quezon City, Philippines, 2-13 October 1989	English
13.	IOC/IODE Training Course on GF3 Data Formatting System Obninsk, USSR, 14-24 May 1990	English
14.	IOC Training Course on Microcomputers and Management of Marine Data in Oceanographic Data Centres of Spanish-speaking Countries, Bogotá, Colombia, 21-30 October 1991	English & Spanish
15.	IOC Advanced Training Course on Nearshore Sedimentation and the Evolution of Coastal Environments, Kuala Lumpur, Malaysia, 17-29 February 1992	English
16.	First IOC Training Course on the Applications of Satellite Remote Sensing to Marine Studies Caracas, Venezuela, 24-28 September 1990	English
17.	IOC-KMFRI-RECOSCIX (WIO) Regional Training Course on Microcomputer-based Marine Library Information Management, Mombasa, Kenya, 10-21 August 1992	English
18.	ROPME-IOC Regional Training Course on Management of Marine Data and Information on Microcomputers for the ROPME Region, Kuwait, 18-28 October 1992	English
19.	IOC-SOA Training Workshop on Environmental Effects on Benthic Communities Xiamen, China, 19-23 October 1992	English

No.	Title	Language
20.	IOC Training Course for the Global Sea Level Observing System (GLOSS) directed to the African and South American Portuguese and Spanish-Speaking Countries São Paulo, Brazil, 1-19 February 1993	English
21.	IOC-SSTC-SOA Training Course on Marine Information Management and ASFA Tianjin, China, 19-30 October 1992	English
22.	First IOC/IOCARIBE-UNEP Training Course on Monitoring and Control of Shoreline Changes in the Caribbean Region, Port-of-Spain, Trinidad and Tobago, 21-30 July 1993	English & Spanish
23.	IOC/WESTPAC Training Course on Numerical Modelling of the Coastal Ocean Circulation Matsuyama, Japan, 27 September - 1 October 1993	English
24.	IOC-JODC Training Course on Oceanographic Data Management Tokyo, Japan, 28 September - 9 October 1992	English
25.	IOC-JODC Training Course on Oceanographic Data Management Tokyo, Japan, 27 September - 8 October 1993	English
26.	IOC Training Course on Ocean Flux Monitoring in the Indian Ocean. Organized with the support of the Government of Germany Mombasa, Kenya, 15-27 November 1993	English
27.	IOC-UNEP-SPREP Training Course on Coral Reef Monitoring and Assessment Rarotonga, Cook Islands, 23 February - 13 March 1994	English
28.	IOC-JODC Training Course on Oceanographic Data Management Tokyo, Japan, 26 September - 7 October 1994	English
29.	IOC-UNEP-WHO-FAO Training Course on Qualitative and Quantitative Determination of Algal Toxins Jena, Germany, 18-28 October 1994	English
30.	IOC Training Course on Oceanographic Data Management for Black Sea Countries Obninsk, Russian Federation, 1-12 August 1994	English
31.	COI-CEADO Curso Regional de Capacitación en Gestión de Datos e Información Oceanográficos Buenos Aires, Argentina, 17-28 de octubre de 1994	Spanish
32.	IOC-UNEP-FAO Training Course on Nutrient Analysis and Water Quality Monitoring Zanzibar, Tanzania, 21-26 November 1994	English
33.	IOC-IOMAC Advanced Training Course on Marine Geology and Geophysics off Pakistan. Pakistan, 12-26 November 1994	English
34.	Training Course on Management of Marine Data and Information for the Mediterranean Region Valletta, Malta, 10-21 April 1995	English
35.	IOC-UNEP-WHO-FAO Training Course on Toxin Chemistry and Toxicology related to Harmful Algal Blooms Trieste, Italy, 3-12 September 1995	English
36.	MAST-IOC Advanced Phytoplankton Course on Taxonomy and Systematics Naples, Italy, 24 September - 14 October 1995	English
37.	IOC-JODC Training Course on Oceanographic Data Management Tokyo, Japan, 16-27 October 1995	English
38.	IOC/IODE Training Course on Marine Geological and Geophysical Data Management Gelendzhik, Russian Federation, 13-29 September 1995	English
39.	IOC/GLOSS-GOOS Training Workshop on Sea-Level Data Analysis, Geodetic & Research Branch Survey of India, Dehra Dun, India, 21 November- 1 December 1995	English

No.	Title	Language
40.	IOC-DANIDA Training Course on the Taxonomy and Biology of Harmful Marine Microalgæ; University of Copenhagen, Denmark, 31 July-11 August 1995; IOC-SAREC-DANIDA Training Course on the Taxonomy and Biology of Harmful Marine Microalgæ; University of Mauritius, Republic of Mauritius, 5-14 February 1996; and Annual Report 1995, IOC Science and Communication Centre on Harmful Algæ, DANIDA, University of Copenhagen, Danish Fisheries Research Institute, Danish National Environmental Research Institute	English
41.	IOC-Germany Advanced Training Course on Bathymetric Charting in the Western Indian Ocean METEOR, 15-29 December 1995	English
42.	COI-SHOA-CICESE Curso Sobre Modelación Numérica de Tsunamis Valparaiso, Chile, 11 de Marzo - 11 de Mayo de 1996	Spanish
43.	Seminario/Taller de la COI/GLOSS-SHN sobre Observación y Análisis del Nivel del Mar para países de habla hispano-portuguesa de Latinoamérica Servicio de Hidrografía Naval (SHN), Buenos Aires, Argentina, 19-27 de noviembre de 1996	Spanish
44.	IOC-INCO-ROPME Training Course on Oceanographic Data and Information Management, Tehran, Iran, 19-30 October 1997	English
44.	IOC-ICSU-IAEA-EU Training Course on Marine Geological and Geophysical Data Management for the Countries of the Black and Caspian Seas Regions, Gelendzhik, Russian Federation, 8-19 September 1997	English
45.	IOC-ICSU-IAEA-EU Training Course on Marine Geological and Geophysical Data Management for the Countries of the Black and Caspian Seas Regions Gelendzhik, Russian Federation, 8-19 September 1997	English
46.	Training Course on Management of Marine Data and Information for the IOCINCWIO Region Mombasa, Kenya, 1-11 December 1997	English
47.	IOC/WESTPAC-SIDA-SAREC-SEAPOL Training Workshop on Operational Data and Information System for the Gulf of Thailand Bangkok, Thailand, 18-21 November 1997	English
48.	SZN-IOC Advanced Phytoplankton Course on Taxonomy and Systematics Vico Equense, Naples, Italy, 10-30 May 1998	English
49.	First IOC/WESTPAC Training Course on Monitoring of PSP Plankton and Shellfish Toxicity, Japan, July 1995 Second IOC/WESTPAC Training Course on Species Identification of Harmful Microalgæ, Japan, February 1997 Third IOC/WESTPAC Training Course on Species Identification of Harmful Microalgæ, Japan, August 1997	English
50.	IOC/IODE-NIO Training Course on Oceanographic Data and Information Management Goa, India, 17–27 October 1998	English
51.	IOC/GLOSS-GOOS Training Workshop on Sea-Level Data Analysis South Africa, 16–27 November 1998	English
52.	IOC-UNEP Germany Training Course on Qualitative and Quantitative Determination of Algal Toxins, Jena, Germany, 2-12 March 1999	English
53.	*Cancelled*	
54.	IOC/GLOSS-GOOS Training Workshop on Sea-Level Measurements, Tidal Analysis, GPS and Gravity Measurements, Satellite Altimetry and Numerical Modelling Sao Paulo, Brazil, 30 August-25 September 1999	English

No.	Title	Language
55.	IODE Training on Oceanographic Data and Information Management for the Spanish-Speaking Countries of Central and South America / Curso de Formación del Iode sobre la gestión de datos e información oceanográficos para los países de habla hispana de América Central y del Sur Rio Grande, Brazil, 20-29 September 1999	English/Spanish
56.	*Cancelled*	
57.	PERSGA/ALECSO-IOC/GLOSS-GOOS Training Workshop on Sea-level Data Analysis for the red Sea and Gulf of Aden Region Jeddah, Kingdom of Saudi Arabia, 15-19 April 2000	English
58.	Third IOC/WESTPAC Training Course on NEAR-GOOS Data Management Tokyo, Japan, 24 January-4 February 2000	English
59.	Fourth IOC/WESTPAC Training Course on NEAR-GOOS Data Management; Tokyo, Japan, 27 November–8 December 2000 *(electronic copy only)*	English
60.	First IOC-Flanders ODINAFRICA Training Course on Marine Data Management, Casablanca, Morocco, 2–13 April 2001 *(electronic copy only)*	English
61.	First ODINAFRICA Training Course on Marine Information Management, Cape Town, South Africa, 29 October–9 November 2001 *(electronic copy only)*	English
62.	First ODINCARSA Training Course on Marine Data Management, Guayaquil, Ecuador, 20-31 May 2002 *(electronic copy only)*	English
63.	Remedial Training Course in Marine Data Management for Côte d'Ivoire, Abidjan, Côte d'Ivoire, 21-29 March 2002 *(electronic copy only)*	English
64.	Second ODINAFRICA-II Training Course in Marine Data Management, Tunis, Tunisia, 29 April–10 May 2002 *(electronic copy only)*	English
65.	*under preparation*	
66.	First ODINCARSA Training Course in Marine Information Management, Mazatlan, Mexico, 29 September – 4 October 2002 *(electronic copy only)*	English & Spanish
67.	IODE Training Course in Ocean Data Management for the Caspian and Black Sea Regions, Tehran, I.R. Iran, 20–30 October 2002 *(electronic copy only)*	English
68.	Fifth IOC/WESTPAC Training Course on NEAR-GOOS Data Management, Tokyo, Japan, 5–16 November 2001 *(electronic copy only)*	English
69.	ODINAFRICA II Remedial Training Course in Marine Data Management (Data Short Course), Accra, Ghana, 14–18 April 2003 *(electronic copy only)*	English
70.	Sixth IOC/WESTPAC Training Course on NEAR-GOOS Data Management, Tokyo, Japan, 21 October–1 November 2002 *(electronic copy only)*	English
71.	Taller de Entrenamiento en Observación y análisis del Nivel del Mar, Valparaíso, 7-17 de abril de 2003 *(disponible solamente en formato electrónico)*	Spanish
72.	ODINAFRICA II Combined Madagascar Marine Atlas Workshop and Remedial Training Course in Marine Data Management for Comoros, Tulear, Madagascar, 30 June – 11 July 2003 *(electronic copy only)*	English
73.	ODINAFRICA II Training Course in Marine Data Management for Mozambique, Maputo, Mozambique, 11–22 August 2003 *(electronic copy only)*	English
74.	Final ODINAFRICA II Training Course in Marine Data Management, Brussels, Belgium, 1–5 September 2003 *(electronic copy only)*	English
75.	Second ODINCARSA Training Course in Marine Data Management, Cartagena, Colombia, 13–17 October 2003 *(electronic copy only)*	English
76.	*under preparation*	
77.	IOC/JCOMM Training Course for the Global Sea Level Observing System (GLOSS) on Sea Level Observation and Analysis, 9–20 February 2004, Kuala Lumpur, Malaysia *(electronic copy only)*	English

No.	Title	Language
78.	First ODINCINDIO Training Course in Ocean Data Management, 10–21 October 2005, Ostend, Belgium *(electronic copy only)*	English
79.	First ODINAFRICA-III Training Course in Marine Data Management, , 11–29 April 2005, Ostend, Belgium *(electronic copy only)*	English
80.	HELCOM/BSRP/ICES and IOC/IODE Training Workshop: Baltic Sea Data Collection— Management, Analysis & Synthesis, 24–28 October 2005, Vilnius, Lithuania *(electronic copy only)*	English
81.	First ODINCARSA-II Data Management Training Workshop, 7–18 November 2005, Ostend, Belgium *(electronic copy only)*	English
82.	Second ODINCARSA Training Course in Marine Information Management, 9 November – 19 November 2005, Ostend, Belgium *(electronic copy only)*	English
83.	Web service development training for ODINAFRICA, 5–9 December 2005, Ostend, Belgium *(electronic copy only)*	English
84.	ODINAFRICA Training course on development of electronic repositories on marine related publications from Africa, 5–9 December 2005, Ostend, Belgium *(electronic copy only)*	English
85.	Third ODINCARSA-I Marine Data Management Training Workshop, 21–26 November, 2005, Ostend, Belgium *(electronic copy only)*	English
86.	IODE/GOOS/JCOMM Combined Modelling and Data Management Training Workshop ("Jamboree"), 5–10 September 2005, Ostend, Belgium *(electronic copy only)*	English
87.	IOC/JCOMM Training Course for the Global Sea Level Observing System (GLOSS) on Sea Level Observation Analysis, 15–26 May 2006, Tokyo, Japan *(electronic copy only)*	English
88.	IOC/JCOMM/GLOSS/ODINAFRICA Training Workshop on Sea-Level Measurement and Interpretation, 13–24 November 2006, Ostend, Belgium *(electronic copy only)*	English
89.	ODINAFRICA Marine Biodiversity Data Mobilization Workshop on Sponges, 4–18 November 2006, Ostend, Belgium *(electronic copy only)*	English