



Indian Journal of Marine Sciences

www.niscair.res.in

CODEN: IJMNB

[ISSN: 0379-5136]

VOLUME 34

NUMBER 1

MARCH 2005

Special Issue

on

Coastal and Marine Biodiversity of Indian Ocean

CONTENTS

Papers

- | | |
|---|-------|
| Coastal biodiversity in the Indian Ocean: The known, the unknown and the unknowable
John Keesing & Tennille Irvine | 11-26 |
| Deep-sea ecosystems of the Indian Ocean
Baban Ingole & J Anthony Koslow | 27-34 |
| Coastal marine biodiversity in East Africa
Charles L Griffiths | 35-41 |
| Biodiversity of the Indian Ocean from the perspective of staghorn corals (<i>Acropora</i> spp)
Carden C Wallace & Paul R Muir | 42-49 |
| Island-coastal and oceanic epipelagic zooplankton biodiversity in the southwestern Indian Ocean
D V P Conway | 50-56 |

Coastal and marine biodiversity of India K Venkataraman & Mohideen Wafar	57-75
On the current status of coastal marine biodiversity in Malaysia A G Mazlan, C C Zaidi, W M Wan-Lotfi & B H R Othman	76-87
Indonesian marine and coastal biodiversity: Present status Malikusworo Hutomo & Mohammad Kasim Moosa	88-97
Coastal and marine biodiversity of La Reunion C A F Bourmaud, A Abouidane, P Boisser, L Leclere, E Mirault & G Pennober	98-103
Mangrove ecosystems of the Indian Ocean region K Kathiresan & N Rajendran	104-113
Polychaete diversity in Indian estuaries S Ajmal Khan & P Murugesan	114-119
IndOBIS, an Ocean Biogeographic Information System for assessment and conservation of Indian Ocean biodiversity Vishwas Chavan, C T Achuthankutty, Edward Vanden Berghe, & M Wafar [IPC Code: Int. Cl. ⁷ G11C 13/00]	120-127
MASDEA- Marine species database for Eastern Africa Edward Vanden Berghe [IPC Code: Int. Cl. ⁷ G11C 13/00]	128-135
Participatory monitoring of changes in coastal and marine biodiversity Greg M Wagner	136-146

A bstracts of the Papers

Indian Journal of Marine Sciences
Vol. 34(1), March 2005, pp. 11-26

Coastal biodiversity in the Indian Ocean: The known, the unknown and the unknowable

*John Keesing & Tennille Irvine

Strategic Research Fund for the Marine Environment (SRFME), CSIRO Marine Research,
Private Bag 5, Wembley 6913, Australia

*[E-mail: john.keesing@csiro.au]

Received 1 April 2004, revised 26 August 2004

In this review, the biodiversity of the coastal marine regions of the Indian Ocean is contrast with that of the Pacific and Atlantic oceans. We discuss the important types of coastal habitats (coral reefs, mangrove forests and seagrass meadows) in the Indian Ocean and their use as proxies for biodiversity. An overview of what is known of coastal marine biodiversity in different parts of the Indian Ocean is assessed by using comparable information on some of the better-known taxonomic groups including corals, mangroves, seagrasses, fishes, marine mammals, turtles, crustaceans and molluscs. We also discuss important gaps in

our knowledge and aspects of the biodiversity that will never be determined either because of changes that have already occurred or because we cannot increase our knowledge at a rate relative to anthropogenically induced change. A framework is proposed for the Indian Ocean based around international cooperation to increase our understanding of biodiversity based on ecosystem bioregionalisation and linkage of this to mechanisms ensuring protection of important and representative areas of coastal marine biodiversity.

[Key words: Indian Ocean, biodiversity, coastal, marine, endemism, bioregion]

Indian Journal of Marine Sciences
Vol. 34(1), March 2005, pp. 27-34

Deep-sea ecosystems of the Indian Ocean

*Baban Ingole

National Institute of Oceanography, Dona Paula, Goa – 403 004, India
and

J Anthony Koslow

CSIRO Marine Research, Floreat, WA 6014, Australia

*[E-mail; baban@darya.nio.org]

Received 8 June 2004, revised 1 November 2004

The deep Indian Ocean is composed of a variety of habitat types, including abyssal plains, oxygenated slopes and basins, seamounts, and trenches. The geomorphological features of the Indian Ocean include mid-ocean ridges, abyssal plains and few deep-sea trenches. Although the Indian Ocean has relatively few seamounts and islands, it contains numerous submarine plateaus and rises. We review what is known of deep-sea benthic habitats studied with modern techniques in the Indian Ocean. Recent biological studies conducted in the Central Indian Ocean Basin (CIOB) suggested remarkably rich and diverse micro-, meio-, macro- and megabenthic communities on the abyssal sea floor. The megafaunal assemblage of the CIOB has high biomass but low diversity. While macrofaunal biomass decreased away from the shore, the meiofaunal biomass increased with distance. The discovery of 'Kairei' and Edmond hydrothermal field near the Rodriguez Triple Junction suggests that mid-ocean ridge systems in the Indian Ocean are potential sites for hydrothermal mineralization and contain active vent fields. There are no available estimates for the numbers of seamounts in the Indian Ocean based on echo sounder recordings. Satellite altimetry data indicate that the Indian Ocean has an intermediate number of generally small to moderate-sized seamounts, mostly associated with its ridge systems. The fauna of Indian Ocean seamounts remains virtually unexplored.

[Key words: Benthic ecosystems, Deep-sea, Indian Ocean]

Indian Journal of Marine Sciences
Vol. 33(1), March 2005, pp. 35-41

Coastal marine biodiversity in East Africa

* Charles L. Griffiths

Zoology Department and Marine Biology Research Institute, University of Cape Town,
Rondebosch 7700, South Africa

* (E-mail: clgriff@pop.uct.ac.za)

Received 1 April 2004, revised 10 August 2004

The Indian Ocean coastline of mainland Africa is over 9 500 km long and comprises the tropical coasts of Somalia, Kenya, Tanzania and Mozambique, plus the subtropical and warm-temperate Indian Ocean coastline of South Africa. The regional marine fisheries catch (Indian Ocean catch only for South Africa) is about 200 000 t, more than 80 % of which is taken from Mozambique and Tanzania. Regional fisheries are dominated by intense artisanal and subsistence sectors, although there are also several commercially important industrial fisheries, mostly targeting lobsters, prawns and squid. No reliable species lists exist for individual countries of tropical Africa, but 11 257 marine species are recorded from the western Indian Ocean region (island states included) and 11 980 species from South Africa (including Atlantic coast).

Comparing these lists by taxonomic group, and with similar lists for Europe (29 713 known species) reveals great disparities in taxonomic coverage and large gaps in the data, especially for smaller sized organisms. It is concluded that less than half of species actually present in East Africa have been described. Existing data are also based largely on shallow-water surveys and the benthic invertebrates of deeper waters, especially those of the continental slope and abyssal zone, remain virtually unexplored.

[**Key words:** Marine biodiversity, species richness, East Africa]

Indian Journal of Marine Sciences
Vol. 34(1), March 2005, pp. 42-49

Biodiversity of the Indian Ocean from the perspective of staghorn corals (*Acropora* spp)

Carden C. Wallace* & Paul R. Muir

Museum of Tropical Queensland, 70-102 Flinders St., Townsville 4810, Australia

* [E-mail: carden.wallace@museum.qld.gov.au]

Received 1 April 2004, revised 11 October 2004

The Indian Ocean represents a vital link in the knowledge of where modern reef-building corals began existence, how they survived changes in the configuration of world oceans and how they will survive into the future. To address the central questions of the Census of Marine Life (CoML) for the Indian Ocean, we use the dominant modern reef-building coral genus *Acropora* as an exemplar, working from a large database of world-wide distributions. Previous biodiversity and biogeographic studies of this genus indicated a demarcation between Indian and Pacific Ocean faunas, despite predominantly widespread distribution ranges. From the distribution of modern and fossil *Acropora* assemblages, it is evident that the genus *Acropora* evolved in either the western Indian Ocean or Mediterranean regions of the late Tethys Sea, rather than the central Indo-Pacific as is often assumed from "centre of origin" models. In this paper, additional data on *Acropora* biodiversity from regions of the Indian Ocean is examined to give a preliminary indication of the nature and origin of their biogeographic relationships. The Indian Ocean has unique faunas particularly in the region of the Red Sea and Arabian Gulf. While it is open to influx of Pacific Ocean species via the Indonesian Throughflow current, there is little likelihood of migration of Indian Ocean species into the Pacific. In the event of continuation of global warming, southerly migration of coral species ranges may also take place. Monitoring for such changes could be built into a further detailed compilation of *Acropora* species composition from sites within the Indian Ocean, which will also lead to finer-scale resolution of the distribution patterns shown here.

[**Key words:** Indian Ocean; biodiversity; reefs; corals; *Acropora*; global warming]

Indian Journal of Marine Sciences
Vol. 34(1), March 2005, pp. 50-56

Island-coastal and oceanic epipelagic zooplankton biodiversity in the southwestern Indian Ocean

D.V.P. Conway*

Marine Biological Association of the United Kingdom, The Laboratory,
Citadel Hill, The Hoe, Plymouth, PL1 2PB, U. K.

*[E-mail: dvpc@mba.ac.uk]

Received 1 April 2004, revised 2 August 2004

The oceanic Indian Ocean zooplankton species and their distributions have been well described, but the zooplankton of coastal regions, particularly around the oceanic islands, has not been well researched, either taxonomically or experimentally. The environment of the Mascarene region in the southwestern Indian Ocean and zooplankton research that has been carried out there is detailed, along with gaps in our knowledge. Suggestions are given for future research, particularly on the zooplankton species adapted to live

in the fluctuating environment of inshore waters, including studies on taxonomy and biodiversity, life cycles, dispersion and genetics. Problems of carrying out taxonomic research are highlighted.

[Key words: Indian Ocean, Mascarene Plateau, islands, zooplankton, dispersal, taxonomy, genetics, biodiversity]

Indian Journal of Marine Sciences
Vol. 34(1), March 2005, pp. 57-75

Coastal and marine biodiversity of India

K. Venkataraman

Marine Biological Station, Zoological Survey of India, 130, Santhome High Road, Chennai-600 028, India

[E-mail: dugong@md2.vsnl.net.in]

and

Mohideen Wafar*

National Institute of Oceanography, Dona-Paula, Goa 403 004, India

*[E-mail: wafar@darya.nio.org]

Received 6 December 2004; revised 6 January 2005 This paper summarizes what is known of the coastal and marine biodiversity of the Indian seas and their various ecosystems, from past literature, museum records and other lesser-known sources of information. The synthesis suggests that the number of species known could be of the order 13,000 or higher. However, the inventory is very detailed only in the case of commercially important groups such as fishes or molluscs and is very weak with respect to minor phyla or microbial organisms. In terms of spatial coverage, probably only two-thirds of the total marine habitat has been covered till today and the remote islands and other minor estuaries still virtually remain untouched. It is, therefore, likely that true inventory of coastal and marine biodiversity could be several times higher than what is known today. Lack of trained taxonomists, however, is a serious constraint to achieve this. Conserving what we have today is hampered by lack of management measures including outreach and our ability to predict what would live in Indian seas, by lack of data relating changes in biodiversity to those of environment.

[Key words: Biodiversity, flora, fauna, Indian coast, threats, natural threats]

Indian Journal of Marine Sciences
Vol. 34(1), March 2005, pp. 76-87

On the current status of coastal marine biodiversity in Malaysia

*A G Mazlan, C C Zaidi, W M Wan-Lotfi & B H R Othman

School of Environmental and Natural Resource Science, National University of Malaysia,
43600 Bangi, Selangor, Malaysia

*[E-mail: mag@pkriscc.ukm.my]

Received 1 April 2004; revised 13 July 2004

The seas surrounding Malaysia is one of the largest continental shelf areas in the world contain very productive and diverse habitat and should therefore be the centre for marine biological research and data collection. Though there have been some studies on marine biodiversity dated back to mid 30's, the data collection and information gathered are however far from satisfaction. The process of data collection is in progress by time and though the process of mega-biodiversity recording is somehow jeopardized by inadequacy of taxonomists in the country. Nevertheless, the status of marine biodiversity studies around Malaysian waters is examined towards a better approach for future prospects in research and management of this valuable yet fragile ecosystem.

[Key words: Marine flora, fauna, coastal diversity, Malaysia]

Indonesian marine and coastal biodiversity: Present status

Malikusworo Hutomo & Mohammad Kasim Moosa

Research Centre for Oceanography, Indonesian Institute of Sciences

Jalan Pasir Putih I, Ancol Timur, Jakarta Utara, Indonesia

[E-mail: hutomo@Oseanografi.lipi.go.id]

Received 1 April 2004, revised 28 December 2004

Indonesia is an archipelagic state, its territory stretches from 6° N to 10° S and from 95° E to 142° E, comprises about 18,110 islands with a coastline of about 108,920 km. About 78 % of the Indonesian territory is covered by waters with shallow seas in the western and eastern parts, the Sunda and Sahul plates, separated by the deep Banda Sea. The diversity of Indonesian marine life is hard to be precisely reported, new species are still being described and many more are still unknown. The Indonesian coastal zone is rich in tropical marine ecosystems such as estuarial beaches, mangroves, coral reefs, seagrass, algal beds and small island ecosystems which are homes of different varieties of living communities with various types of association as well as richness in species diversity. Other coastal habitats such as sandy and muddy shores, sand or mud flats, although hosting relatively poorer biodiversity but they are scientifically interesting. Each of these marine ecosystems, with their associated habitats, supports a wealth of marine biodiversity which are not well explored and very poorly documented. The data of marine organisms herewith presented shows that information on many marine taxa, especially animals, are very poor.

[Key words: Marine biodiversity, marine ecosystems, Indonesian waters]

Coastal and marine biodiversity of La Réunion

*C. A. F. Bourmaud¹, A. Abouïdane², P. Boissier², L. Leclère¹, E. Mirault³ & G. Pennober⁴

¹Laboratoire d'Ecologie Marine (ECOMAR), Université de La Réunion, Faculté des Sciences et Techniques, BP 7151, 97715 Saint-Denis Messag. Cedex 9, La Réunion, France

²Institut de Recherche en Mathématiques et Informatique Appliquées (IREMIA-ETIC Program), Université de La Réunion, Faculté des Sciences et Techniques, BP 7151, 97715 Saint-Denis Messag. Cedex 9, La Réunion, France

³Institut de Recherche et Développement (IRD), BP 172, 97492 Sainte Clotilde cedex, La Réunion, France

⁴Centre de Recherche en Géographie de l'Université de la Réunion (CREGUR-ETIC Program), Université de La Réunion, Faculté des Lettres et Sciences humaines, BP 7151, 97715 Saint-Denis Messag. Cedex 9, La Réunion, France

[*E-mail: chloe.bourmaud@univ-reunion.fr]

Received 1 April 2004, revised 27 September 2004

Réunion Island marine biota comprise 4374 taxon records. Algae, scleractinians, hydrozoans, molluscs (except nudibranchs and cephalopods) and vertebrates are the better known taxa. Sponges, cnidarians (except hard corals and hydroids), crustaceans and echinoderms are zoological groups that need more investigations. Species diversity of ctenophores, platyhelminthes and others worms, lophophorates and tunicates is completely unknown. In order to increase accessibility to these records, taxa and species distribution data have been recorded in a new online interoperable database, developed by software engineers of Réunion University, and integrated in the information system of the coastal zone network

project (Système d'information du Littoral, SIL). Rocky coasts constitute the largest coastal marine habitat of Réunion Island, but coral reefs have been more investigated. Among them, the Saint-Gilles/La Saline coral reef complex is the most studied area and the other reefs and platforms have been neglected so far. Further, hardly any studies exist for the rocky coast and the deep-water ecosystems. Although Réunion coral reefs shelter 191 species registered either in IUCN red list (2003), CITES, CMS and regional Nairobi conventions, the marine biodiversity and the coastal habitats are under increasing anthropogenic threats. In spite of the high species richness, the high number of threatened species and the numerous economic activities that depend of the health of coral reefs, no marine protected areas exist as yet in Réunion, mainly because of disagreements between stakeholders.

[Key words: Marine biodiversity, biota, coral reef, human impact, database, GIS, Réunion Island]

Indian Journal of Marine Sciences
Vol. 34(1), March 2005, pp. 104-113

Mangrove ecosystems of the Indian Ocean region

K. Kathiresan & N. Rajendran

Centre of Advanced Study in Marine Biology, Annamalai University,
Parangipettai-608 502, Tamil Nadu, India
(E-mail :cdl_aucasmb@sancharnet.in)

Received 1 April 2004; revised 17 September 2004

Covering about 47 % of world's mangrove area, containing 85 % of world's mangrove species, and occurring in a variety of habitats, the mangrove ecosystem plays a vital role in coastal biodiversity of 30 countries bordering the Indian Ocean. This ecosystem supports a rich species diversity of flora and fauna, but it is facing heavy human pressures and natural stresses, leading to a loss in biodiversity. This calls for urgent measures of conservation and management.

[Key words: Mangroves, Indian Ocean, East Africa, Arabian Peninsula, Indo-west Pacific, NW-Australia, associated flora, fauna, ecosystems]

Indian Journal of Marine Sciences
Vol. 34(1), March 2005, pp. 114-119

Polychaete diversity in Indian estuaries

*S. Ajmal Khan & P. Murugesan

Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai—608 502, Tamilnadu, India
*[E-mail: s_ajmalkhan@rediffmail.com]

Received 1 April 2004; revised 21 September 2004

This paper provides a comprehensive account of the diversity of estuarine polychaetes of India. Information on polychaetes is available only from 8 estuaries out of 33 on the east coast and only from 4 out of 34 on the west coast. 153 species of polychaetes occur in Indian estuaries, representing about 37.46% of the total polychaetes present in Indian seas. While 119 species were found to occur only in east coast estuaries, 11 species were found only in the west coast estuaries. Twenty-three species were found to occur in the estuaries of both the coasts. Besides increasing the extent of coverage on the distribution of polychaetes from other Indian estuaries, there is also a strong need to understand the variations in their diversity in relation with environmental changes, especially in terms of pollution. This could become possible only with application of tools like genetic and biochemical make-up and improved statistical analyses to explain variability of diversity of polychaetes in space and time.

[Key words: Polychaetes, diversity, estuaries]

IndOBIS, an Ocean Biogeographic Information System for assessment and conservation of Indian Ocean biodiversity

*Vishwas Chavan¹, C. T. Achuthankutty², Edward Vanden Berghe³ & Mohideen Wafar²

¹Information Division, National Chemical Laboratory, Dr. Homi Bhabha Road, Pune 411008, India

²Biological Oceanography Division, National Institute of Oceanography, Dona Paula, Goa 403004, India

³Flanders Marine Data and Information Centre, Flanders Marine Institute, Vismijn, pakhuizen 45-52, 8400 Oostende, Belgium

*[E-mail: vishwas@ems.ncl.res.in]

Received 1 April 2004; revised 10 January 2005

Compilation of inventories of components of coastal and marine biodiversity of Indian Ocean is hampered by several factors: low effort by some countries, preference to certain taxon, dwindling taxonomic expertise, low infrastructure of Information Technology, databases that are scattered and often non-interoperable, inconsistent reporting and a marked reluctance to share data and information. The creation of the Indian Ocean node of the Ocean Biogeographic Information System is meant to overcome some of these constraints. Benefiting from progress in Information Technology and building on the global efforts on understanding what lives in our seas, the IndOBIS aims to grow into a self-sustaining and collectively supported process of information collation, analysis and dissemination, serving the countries of the region and the international scientific community.

[Key words: Information systems, distributed database systems, biogeography, biodiversity informatics, Indian Ocean, Ocean Biogeographic Information System, IndOBIS.]

[IPC Code: Int. Cl.⁷ G11C 13/00]

MASDEA—Marine species database for Eastern Africa

Edward Vanden Berghe

Flanders Marine Data and Information Centre, Flanders Marine Institute
Vismijn, pakhuizen 45-52, 8400 Oostende, Belgium

[E-mail: wardvdb@vliz.be]

Received 1 April 2004; revised 24 December 2004

The Marine Species Database for Eastern Africa (MASDEA) was started in 1996, in the framework of a collaborative project between the Regional Cooperation in Scientific Information Exchange – Western Indian Ocean (RECOSCIX-WIO) and the Kenya Marine and Fisheries Research Institute (KMFRI). Since then, it has grown to a substantial database, with over 20,000 taxonomic and 50,000 distribution records. Since 1999, the database has been online, through the web server of the Flanders Marine Institute (VLIZ), and has attracted a reasonable amount of hits, some resulting in comments, and corrections and additions to the content. Some of the decisions taken at the design stage of the database are discussed. A preliminary analysis of the data in the database is presented. This clearly shows a marked ‘observer’ bias, and demonstrates the need to continue the efforts of collecting information.

[Keywords: Biodiversity; information systems; western Indian Ocean]

[IPC Code: Int. Cl.⁷ G11C 13/00]

Participatory monitoring of changes in coastal and marine biodiversity

*Greg M. Wagner

Department of Aquatic Environment and Conservation, Faculty of Aquatic Sciences and Technology,
University of Dar es Salaam, P.O. Box 35064, Dar es Salaam, Tanzania
*[E-mail: gwagner@udsm.ac.tz]

Received 1 April 2004, revised 4 October 2004

This study reports results obtained from participatory monitoring conducted in Tanzania in two types of keystone ecosystems, mangrove forests and coral reefs. The report also analyses participatory monitoring as an effective tool in environmental conservation and management. Participatory monitoring data collected from three mangrove areas subjected to different levels of human impacts, low, moderate and high, clearly indicated the effects on mangrove basal area and species diversity. Participatory coral reef monitoring clearly showed degradation due to human impacts in one area and definite positive trends over time due to management interventions in another area. Participatory monitoring produces large amounts of informative data in a short time at low cost. Moreover, it has profound positive impact on the participants in terms of enhancing their environmental awareness, creating a feeling of “ownership” of the environment and motivating them to protect and restore the ecosystems they monitor. However, in order for participatory monitoring to be successful, there should be proper selection of participants, adequate training and on-going supervision by experts.

[Key words: Participatory monitoring, coastal/marine, keystone ecosystems, biodiversity]
