INDOBIS AND ITS RELEVANCE TO THE GULF OF MANNAR BIOSPHERE RESERVE

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Introduction

The Gulf of Mannar (GoM), which has been given the status of a Biosphere Reserve in 1989 under the Man and Biosphere Reserve Programme of UNESCO. It was declared as the first marine protected area in South and South east Asia, owing to its geographical, ecological and biological features.

IndOBIS (Indian Ocean node of OBIS) is one of the seven regional nodes established by the OBIS (Ocean Biogeographic Information System), which is the data and *information* component *of* Census of Marine Life (CoML). It harbors species and related metadata on Indian Ocean region. In the present paper, we are describing the functions and role of these worldwide initiatives and the need to have quality data of species in computerized online databases where it can be accessed by anyone at any time. We also emphasize here the need to have a central data facility for marine biodiversity and the importance of sharing the data in the context of conservation of GoM Biosphere Reserve.

Basic Requirements

Diverse data sets such as species, biogeography, museum specimen, ecology, climate change, traditional knowledge, environment, bathymetry etc. are very critical for making forecast on the species, community and/or the ecosystem.

The question is, with these diverse kind of data can we answer the following three basic questions on any species? How many species lived in the past? How many species *are* present now? How many species will exist in future?

Need of a Central Data Facility System

Biodiversity is rich in developing countries whereas biodiversity information is concentrated in developed countries. Scientists find it difficult to discover, access and use biodiversity data because of the mismatch between the distribution of biodiversity, and the distribution of the data, and most importantly, the complexity of biodiversity data.

For the sustainable utilization of biodiversity resources mankind must learn how to exploit the massive data sets, how to store and access them for analytic purposes. We must unlock the knowledge and economic power lying dormant in the masses of biodiversity that we have on hand that is stored in static media. All of this informatics capability is needed because, we are losing at an ever-increasing rate both species that we know and ten times as many that we don't know.

IndOBIS (http://www.indobis.org)

IndOBIS is the Indian Ocean node of OBIS (http://www.iobis.org), which is the data and information component of the Census of Marine Life (CoML, http://www.coml.org). It is initiated with the objectives to understand species occurrence (type, census, distribution pattern, biological threat category, bioinvasion), ecological impact on biota, seascape ecology, phylo-and macro-geography evolution of fauna and flora at population and species levels), marine bio-terrorism informatics etc. The National Institute of Oceanography (NIO), Goa and the National Chemical Laboratory (NCL), Pune have been jointly interested to develop this regional node and have been managing it since 2004.

IndOBIS- Mission

Indian Ocean (IO) is the third largest ocean in the world. It is different from other oceans in social, cultural, economic and ethnic aspects. It is a significant contributor to the production of marine living resources. About 10% of world's population lives within 100 km of IO shores, but is the least studied for its biodiversity.

IndOBIS will contribute to the understanding of the past and the present, in order to learn about the future of life in the Indian Ocean. It will become a prime provider of biodiversity information on the Indian Ocean, and make this available in a multi-dimensional geographic context; promote communication and awareness to user groups at all levels, using appropriate information tools; and enable informed decision-making process, leading to sustainable use of natural resources.

IndOBIS - features and status

IndOBIS has administrative tools for online contributions with special quality control, authentication and validation methods. It has various web search modules for data use applications. The database has adopted Cavilier Smith's 8 kingdom classification system.

Features of the database include Scientific names, Common and local names, Locality records,

Mostly faunal species, QA/QC exercise is in progress, Network of distributed taxon editors

Data statistics of the IndOBIS database (as on September 2007) is, 41404-Scientific names, 25698-Synonyms, 10336- Common names, 96955-Locality records with 70905 - Unique localities. Average number of localities per scientific name is 2.34.

IndOBIS database has been developed with the dream mission of making it as a potential data provider on species, biogeography, ecosystem, molecular, and sequence data, electronic literatures/articles, experts/ institutions, traditional knowledge of flora and fauna from the Indian Ocean. IndOBIS will serve as a centralised facility holding a treasure-trove of biodiversity data which can be accessed by anybody at anytime (Fig-1).
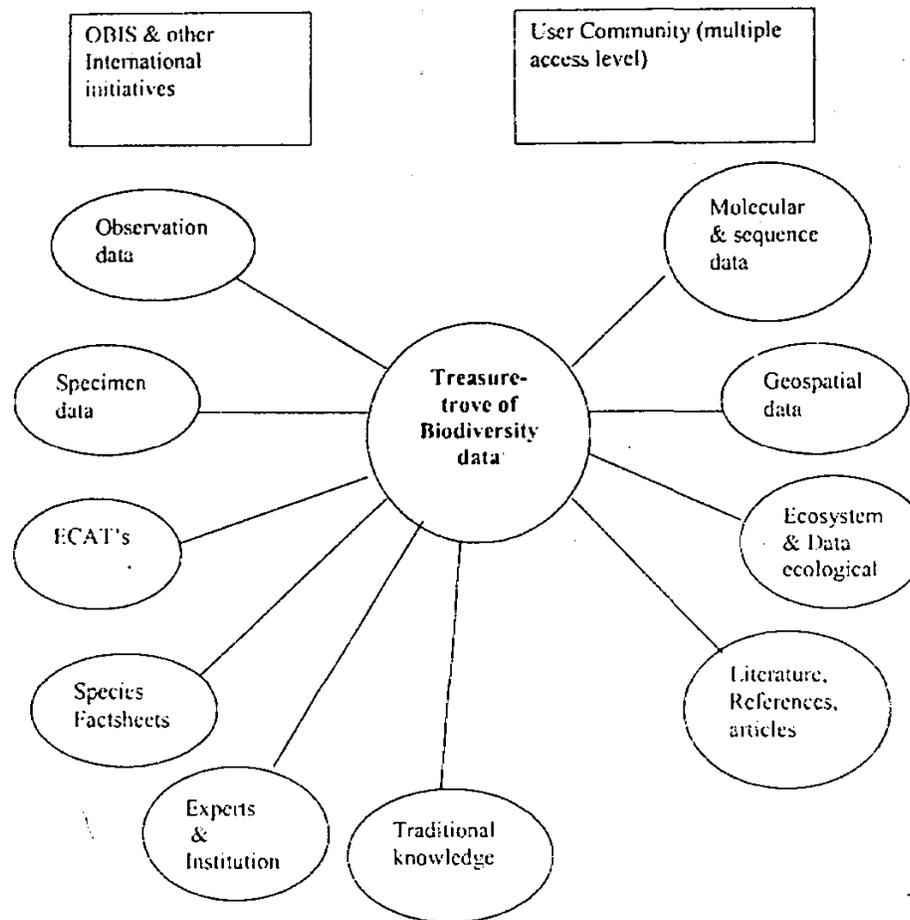
Fig.1. A Diagrammatic representation of future perspectives of IndOBIS.

Gulf of Mannar Biosphere Reserve

The Gulf of Mannar is a large shallow bay lies between the southeastern tip of India and the west coast of Sri Lanka (8°49' to 9° 15' N latitude and 78°11' to 79°15' E longitude) with widths between 160 and 200 km. It covers an area of 1,050,000 hectares and encompasses 21 coastal islands with estuaries, beaches, forests of the nearshore environment, including a marine component with algal communities, sea grasses, coral reefs, salt marshes and mangroves. It is one of the world's richest regions from a marine biodiversity perspective.

The Government of India, has established the Gulf of Mannar Biosphere Reserve, in 1989, the first of its kind in South and South East Asia, with the basic objectives of conserving *in situ of* biodiversity of natural/ semi-natural ecosystems and landscapes, contributing to sustainable economic development of the human population living within and around the biosphere reserve and providing facilities for long-term ecological studies, environmental education, training, research and monitoring related to local, national and global issues of conservation and sustainable development. It is the first Indian marine national park which is internationally recognized under the UNESCO-MAB (Man And Biosphere) program. It is rich both in species and habitat biodiversity. The reserve has a status of particular concern because of its diversity and special multiple use management status.

Ecological Importance

The Reserve harbours marine biodiversity of global significance and is renowned for its coral reef, sea grass and algal communities. The islands are referred as a "biologist's paradise" and it contains over 3,600 species of flora and fauna most of which are in their virgin form. The sandy shores of the islands provide an excellent foraging habitat for 5 species of marine turtles. Nearly 117 species of hard coral have *been* recorded from here . The reef is home to sprats, herrings, barracuda, sea horses, dolphins, balanoglossus, sea cucumbers, and pearl oysters. Migratory birds also visit these Islands. International Union for Conservation of Nature's Commission of Natural Parks and Protected Areas has identified this reserve as one of the priority sites for treatment on account of its diversity and multiple use status.

The Algae Resources

Seaweed or marine algae are renewable important marine living resources. Gulf of Mannar marine area has more than 147 species of sea weeds, majority are found in the reef regions. *Padina* was observed on the shores and lagoons. *Gracilaria lichenoides was* found more on the shore and lagoon than on reefs. The predominant species on the coral reefs is

Halimeda opuntia. Sargassum and *Turbinaria* are found on the shoreward part of the reefs. *Caulerpa, Sargassum, Amphiroa fragilissima* are the other dominant species.

Seagrass Eco-system & Higher plants

Out of the 14 species of seagrasses under six genera known from Indian seas, thirteen species occur in the Gulf of Mannar Biosphere Reserve (Venkataraman & Wafar, 2005), dominated by family like Hydrocharitaceae, Potamogetonaceae and species *Thalassia hemprichi, Halophila ovalis, H.ovata, H.beccari, H.spipulacea, Halodule uninervis, Cymodocea rotunds, C.serulata.* All the 11 sea grasses of India occur here with *Enhalus acoroides* being endemic. The sea grass beds provide feeding grounds for the highly endangered sea-mammal *Dugong dugon* and a suitable habitat for many marine animals for spawning.

The area has all the mangrove species available in India *(Rhizophora muctonata, Avicennia alba, Bruguiera gymnorrhiza, Ceriops tagal, Lumnitzera racemosa),* with *Pemphis acidula* being endemic.

The angiosperm flora of Gulf of Mannar has a total of 784 taxa which includes 764 species and 20 infraspecific taxa (Subspecies /varieties). They belong to 433 genera and 113 families.

Endemic plants

There are 46 endemic taxa including one subspecies and 7 varieties. Species endemic to Gulf of Mannar: *Acrachne henrardiana, Acrachne sundararaji, Ceropegia mannarana, Chloris wightiana, Ipomoea pes-caprae var. perunkulamensi, Iseilema jainiana, Jatropha villosa var. ramnadnesis, Leucas anandaraoana, Perotis indica var. keelkaraiensis.*

The Coral Eco-system and Major Invertebrates

The corals are commonly called "Ever Green Forest of the Sea". Nearly 117 species of Hard coral belonging to 37 genera (Kelleher, 1995) have been recorded from here . The reef is home to sprats, herrings,

barracuda, sea horses, dolphins, balanoglossus, sea cucumbers, pearl oysters and turtles. As many as 133 species are found in the Gulf of Mannar- region.

The invertebrates are represented by 280 species of sponges, 92 species of corals, 22 species of sea fans, 160 species of polychaetes, 35 species of prawns, 17 species of crabs, 7 species of lobsters, 17 species of cephalopods and 103 species of echinoderms.

Vertebrates

Fishes and Marine Turtle

Of the 2200 fish species distributed in Indian water 450 species have so far been recorded in this area. Five species of marine turtles are known from this area. They are the Hawks bill turtle, Green Turtle, Olive ridley, leatherback turtle and Logger head turtle. All turtles are becoming highly endangered.

Avifauna

The island of Gulf of Mannar with their luxuriant mangrove vegetation, mudflats and coral reefs form an important resting place for the birds migrating to and from other countries. The diversity of eco-system in the area has made in the wintering and mounting ground for many thousands of waders. More than 168 species of birds have been recorded

Mammals

Dolphins, Dugongs and whales represent the marine mammals in the Gulf of Mannar. The sea cow (*Dugong dugon)* and Baleen Whale are critically endangered living in this region.

Reference of IndOBIS to GoMBR Conservation

IndOBIS database currently holds a total of only 111 species records, mostly faunal from Gulf of Mannar region.

The phylum-wise statistics is given below :

Annelida- 4; Arthropoda -12; Chordata -24; Cnidaria-18; Coelenterata-1; Echinodermata-10; Mollusca -13; Porifera-3; Chlorophyta-2; Rhodophyta-6, and Retaria-18.

Potential Gaps

While more than 3600 species of flora and fauna have been recorded from GoM region, only less than 5% of original available information could be added to IndOBIS database. There is a wide gap between the actual information and the available information. How can we fill these gaps?

Here is the need of active data sharing from other organizations, database collaborations, individual data holders, tangible and online resources etc . Unfortunately, species and biodiversity data are possessed by individual scientist/taxonomist or some institutions which cannot be accessed by others. Therefore, these valuable data are not available for developing realistic niche models or ecological models and also for planners/ managers to rely on to take decisions for conservation and sustainable use of these bioresources.

What you can do?

We need your valuable participations in the following ways to make IndOBIS a potential marine data provider.

- Comment on IndOBIS web sites and portal, it is as good as you help make it.

- Assist IndOBIS networking to scientists.

- Promote need for IndOBIS to governments and funding agencies.

- Encourage data publication through IndOBIS new datasets, newly digitized data, and compliment those who have published online databases.

Gulf of Mannar Biosphere Reserve -

An ecological model for Biodiversity conservation, livelihood & sustainability

The GoMBR has a sound resource base. From the biodiversity perspective it is known as "biologist's paradise". Diverse forms of fauna and flora with complex, interdependent fragile ecosystems with high degree of endemism making it one of the potential field area for science related activities. Being renewable resources, presently over 40,000 local fisherman in a population of 1.60 lakhs living in 125 villages directly depend on these marine resource.

Over the years the marine wealth of GoM has been over exploited, leading to drastic loss of resources and diversity. The resources of the region are being overexploited beyond the carrying capacity due to overfishing, destructive fishing practices, lack of awareness etc. Of late, the agriculturists from the main land area are switching over to fishing activities in a big way due to consistent failure of monsoon. This adds a new dimension to the already existing pressure on the marine resources of the area. However, It is estimated that for every 1000 kg of fish collected, 325 kg of variety of marine organisms are discarded and allowed to die outside the sea. Thus huge quantities of a wide variety of untargeted marine organisms are thrown on the shore as debris. Further illegal coral mining for cement industries and indiscriminate collection of sea grass for industrial use collectively cause the collapse and breakdown of variety of sensitive marine eco-system. Presently, it is estimated that 65% of the existing coral reefs in the project area are dead, mostly due to human interference.

Time seems to have exceeded to adopt different strategies for protecting this internationally recognized marine park, which is an ecological model from the biodiversity, *socio-economic* and renewable resource perspectives. Here we are reviewing the various strategic measures from an informatics point view.

Computational approach to conservation strategy

Project Activities and Databases

Projects regarding the systematics, ecology and biodiversity of GoM will be an analytic tool to know the existence of biota (past, present and future), ecological behavioural pattern, biogeographic pattern, biochemistry, evolutionary aspects etc. Design and creation of comprehensive databases (dedicated to GoM), which can be accessible to each and everybody, including common man, is a major information facility.

Digital Libraries

Museum specimen data are a vital source of ancient history. Since, the biological specimens are getting disintegrated by the time, the digitization of museum collections are gaining momentum. Accessibility and usability at any time makes the digital libraries one of the important tool for taxonomic identification of species. Therefore, there is an urgent need to digitalize all the specimens available from GoM along with all available metadata and make these available online.

Bio- Softwares and Tools

Computational softwares and tools are used to manage the large, complex metadata elements.

A relatively new virtual modeling approach, ecological niche modeling is used to predict the range of a species, bio-invasion etc. GARP (Genetic Algorithm for Rule-set Prediction) software is used for ecological modeling. By predicting the distribution of a species using its current distribution, we can create a virtual distribution containing the predicted occurance. This technique will be significant in the case of biologically threatened species, since it will show whether this species will become extinct or exist in the near future. It can also be effectively used for predicting the movement and settling of bio-invasive species.

This is the era of converging sciences. Every discipline is merging with information technology. The species interactions are the source of emergent properties of ecological systems. Emergent properties then give rise to further interactions. The challenge of incorporating the living nature of natural systems with information technology is increasing as the result of all biotic and abiotic interactions. Informatics approach is needed because we *are* losing our wealth of biodiversity at a rapid rate, both species that we know and ten times as many, those we do not.

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