First Indian Ocean Workshop on Marine Biodiversity:
The known, the Unknown and the Unknowable

Introduction

There has been a renaissance of taxonomy and related subjects such as abundance and distribution of species as biodiversity in the last two decades. This has resulted from growing awareness that ecological, economic and livelihood securities of mankind are inseparably linked with the maintenance of the diversity of the biological components in land, water and atmospheric environments. Nowhere is the fact so well demonstrated as in the list of extinct and endangered species that has grown over several folds in the last few decades and *continues to grow every day*. Decrease in forest cover and the resultant loss of animal and plant life has already compromised the livelihood of a large number of village communities around the world. Shifting emphasis to monoculture in agriculture threatens the ecological security in many countries. While the prospect of genetic improvements to conventional biological components may strengthen economic security, its own destruction could not be far behind if the mastery over the Genetically Modified Organisms is lost. Poor as it is, our knowledge of the biodiversity on land and their importance for mankind far exceeds our knowledge of the marine biodiversity and its links to the livelihood and quality of life of people, especially of coastal communities.

We are now certain that most of the world's biodiversity is concentrated in the land and water environs of developing, relatively more populated, countries located in the tropics. The certainty ends here. We do not know what is the full range of existing biodiversity or what ecological and livelihood securities they can offer. Nor do we know at what stage the degradation of the environment could have a non-reversible impact on biodiversity.

The degree of ignorance is much greater with marine biodiversity. At a conservative estimate, we may know not more than a few percent of all species thought to occur in the marine environment. Besides food fishes, the marine biodiversity is a vast reservoir of bioactive molecules, but we are only at a very elementary stage of beginning to understand this, let alone explore or exploit it. For long, we treated all coastal marine ecosystems as bottomless recipients of wastes generated onshore but we now realize that we stand to lose, sooner rather than later, the services and values these ecosystems and their biological constituents render, if we persist with the abuse.

Genesis of the proposal

During the coastal sessions of the Conference on the Indian Ocean Observing System (IOGOOS) at Mauritius in November 2002, there was general agreement that sustained observations at multiple levels of the coastal habitats and their biodiversity should be a developed as a Pilot Project. It was also recognized that the full scope of the problem could not be addressed uniquely within the context of IOGOOS, and that there was also need for a parallel research programme on the topic. Such a research

programme would address many questions of technical and scientific nature that go beyond the purview of operational observations of the type envisaged within GOOS. A pre-requisite for initiating such a study is the assessment of the current state of the coastal and marine biodiversity and identification of priority areas for research on marine biodiversity in the Indian Ocean region. A regional workshop, with participants drawn from Indian Ocean Rim countries and some experts from outside the region, could help focus our research efforts on marine biodiversity and foster better co-operation between the countries of the region. It was recognized that the international programme Census of Marine Life (CoML) could provide just the right framework for such an initiative. The organization Partnership for Observation of the Global Oceans (POGO) was identified as the potential facilitator for the venture.

Role of Census of Marine Life (CoML)

The CoML is a research program that envisages assessing and explaining the abundance of and the changes in the biodiversity in the world oceans. Began in 1997, the CoML is scheduled to culminate in 2010 with a report on the state of life in the world oceans. The goal of CoML is to collect information on what is known, unknown and unknowable of the biodiversity in the seas and use this knowledge to serve the objectives of the Convention on Biological Diversity (CBD).

Nowhere in the history of time has there been an opportune moment as of now for a project like CoML. The continuing degradation of the environment and accelerated climate changes as a consequence of human interventions are beginning to impact on marine biodiversity in a way we have not even thought of before. The information generated by CoML by conventional means and by application of improved technologies should prove critical for resource management in the years to come.

CoML not only advocates newer technologies but has also put them into play. The Ocean Bio-geographical Information System (OBIS) developed by CoML is a state-of-art data assimilation framework that enables visualization of data on biological components of any ocean at the click of a mouse, from a laptop or a desktop.

Whereas CoML is now active in many parts of the world oceans, its presence in the Indian Ocean is very limited, as of now. A marine biodiversity initiative in the Indian Ocean would benefit tremendously by building on existing CoML programmes, and extending them to the Indian Ocean region as appropriate.

Known, unknown and unknowable of the Coastal Marine Biodiversity of the Indian Ocean

Historically, knowledge of the biodiversity of the Indian Ocean has been limited, in comparison with Atlantic and Pacific Oceans. It was only when the International Indian Ocean Expedition (IIOE) was carried out in the 1960s that a certain level of understanding of the marine biodiversity of the Indian Ocean was achieved.

The benefits of IIOE did not spread uniformly among the Indian Ocean countries, the chief constraints to this being shortage of manpower and economic inequalities limiting development and maintenance of infrastructure needed for sustained biodiversity surveys and census. Thus, while all the countries of the Indian Ocean can be expected to have a high diversity, the extent of knowledge of this diversity is disproportionately low. Even the 26,000 species catalogued in India could only be a vast underestimate, since spatial and temporal coverages are still woefully inadequate. A case in point is the poor coverage of most coral reef fauna and flora below skin-diving depth or on remote reefs. Even the vast oceanic regime is grossly under-sampled, with only three locations in seamounts having been sampled till date.

Compounding our limited knowledge of the biodiversity in Indian Ocean region are several related critical gaps that include:

- How can we improve our knowledge of species diversity of little known groups, such as sipunculids, prochordates, protistes, sponges, soft corals ?
- What are the relationships between oceanic and coastal dynamics and regional variability in species diversity and population structure?
- What are the scientific, technical and institutional strengths that can be harnessed, or built, to increase the inventory of biodiversity in the region?
- How do we evaluate habitat loss and modifications and their impacts on biodiversity?
- What is the rate of loss of species, if any, in the region?
- What are the levels of sustainable uses in cases of harvested biodiversity?
- What is needed to enhance novel uses of biodiversity, such as bioactive molecules?
- What are the impacts of natural variability and human activities on marine biodiversity?

In describing the unknown, it is essential to look at the interplay between biological diversity and human development. Unlike in other marine regions, a scientific study of biodiversity in Indian Ocean cannot be carried out in isolation, without trying to understand how human interventions impact biodiversity and how these could be mitigated. The Indian Ocean countries are home to a third of the global population, a substantial fraction of which live off the marine resources and the coastal habitats. The pressures from high population density and high poverty levels are such that human survival takes precedence to concerns over loss of biodiversity. Faced with such dire prospects, it becomes important to understand not just the species diversity in the region, but also how the impact of human activities affects the regional biodiversity. It also becomes important to understand the links between biodiversity and benefits to mankind. Unfortunately, all these aspects of biodiversity are very much in the realms of the unknown, at present.

The situation is further aggravated by the limited opportunities for interactions between scientists in the region, because of economic, cultural and linguistic barriers. A consequence is that the compilation and consolidation of existing knowledge from the

region has been problematic. Because of poor facilities for data storage and distribution, the threat of losing accumulated knowledge is also acute. It is therefore paramount that we design means for cataloguing existing knowledge, before it is lost.

The potential exists for pushing back significantly the limits of existing knowledge on biodiversity of the Indian Ocean region, by initiating a co-ordinated effort to sample the region for their flora and fauna. Undoubtedly, such an effort, over the next decade or so, has excellent prospects of discoveries of new species and new insights into the function and role of the marine biota of the Indian Ocean region. The task is to identify areas of common interest and priorities to the countries of the region, and to focus the joint effort on those areas from which maximum results may be anticipated in the near future. In planning this activity, one would also have to remain pragmatic and recognize that some aspects of marine biodiversity will remain unexplored and therefore unknowable, in the short term. Furthermore, one would never be able to evaluate fully the loss to biodiversity that the region has already experienced due to the degradation of the environment.

Taking the above into consideration, we shall try to:

- Synthesize our current knowledge of the coastal and marine biodiversity of the region and identify the gaps;
- Suggest strategies to fill up these gaps – including augmented surveys, linking to other CoML activities, developing new technologies and tools, and through training, education and building public awareness;
- Propose methods to increase accessibility to, and protection of, existing information through improved data management and distribution strategies; and
- Speculate on the evolution of the drivers of change on how best they could be managed.

Importance of the proposal

The Indian Ocean accounts for 29% of the global ocean spread, 13% of the marine organic carbon synthesis, 10% of the capture fisheries, 90% of the culture fisheries, 30% of coral reefs, 10% of mangroves and has 246 estuaries draining hinterland greater than 2000 km^2, besides coastal lagoons and backwaters. Being landlocked in the north, and with the largest portion of it lying in the tropics, the Indian Ocean is also a region of high biodiversity, with one of the countries in the region, India, rated as one of the mega-biodiversity centers of the world.

Indian Ocean is also a region of developing countries (with the exception of Singapore) and has the greatest concentration of the world's population (30%) within 100 km of the coast. With most countries, the priorities being industrial development and poverty alleviation, assessment of the biodiversity has generally had a lesser importance. The net result is that we know still little of what biodiversity we have and, alarmingly, what fraction of it we are losing.

In the current context of international trade and intellectual property regimes, it is important for all of the Indian ocean countries to understand their marine biodiversity. The countries of the region also must understand what is need to enhance this knowledge (What tools and capacity building is required) and how to design principles of sustainable utilization for those species that have economic value (food fishes and bio-molecules, for example).

The proposed workshop is intended to set this process in motion such that the regional nations as a whole benefit from cross-fertilization of knowledge and ideas. However, in this initial step, the focus will be on bringing together scientists from the region who are already active in the field, with a view to developing plans to improve the network in the future.

Objectives

1. To compile and consolidate existing information on the biodiversity of various habitats and regions of the Indian Ocean (including both coastal and open-ocean) and to make that information available in a collection of peer-reviewed publications.

2. To identify regional priorities for biodiversity studies and develop research initiatives around these priorities.

3. To develop ways and means of improving data archival and management of existing information on marine biodiversity in the Indian Ocean, with a view to preventing their loss, and improving access to existing data.
4. To create a regional network of scientists interested in marine biodiversity of the Indian Ocean region, to facilitate exchange of information and data, and to co-ordinate scientific efforts.

5. To establish links with CoML initiatives in other regions.

Workshop structure

Part 1. Presentations by CoML and POGO representatives of the activities of their respective organizations and their expectations from the workshop. Presentations by Chair, COOP and IOC regional office on Coastal and Marine Biodiversity in the IOGOOS context. Presentation by invited experts that would include at least one on taxonomic tools.

Part 2. Presentation by invited scientists from Indian Ocean rim countries on the current status of coastal and marine biodiversity in the region.

Part 3. Group discussions to identify

- New projects
- New tools
- Data management

Part 4. Group discussions with CoML, POGO and IOGOOS representatives and linking the proposed programs with other initiatives.

Background paper for the meeting

A short background paper will be prepared and distributed to the participants in advance of the workshop. The paper will outline the motivation for the workshop, the anticipated outputs, the work that has to be carried out prior, during and after the meeting, to attain the stated goals of the workshop, and also provide some relevant information on CoML and POGO. The organizing committee will be responsible for producing the background paper for distribution to the invitees.

Expected outputs

General:

- A better understanding of the current state of coastal, and open-ocean marine habitats and their biodiversity in the Indian Ocean region;

- Establishment of priorities and Development of plans for a research programme on marine biodiversity in the Indian Ocean region (coastal and open-ocean)

- Establishment of links to plans for sustained observations within the Indian Ocean (IOGOOS)

- Establishment of links to CoML initiatives in other regions

- Publication of the proceedings in a special issue of the *Indian Journal of Marine Sciences.*

Specifics:

- Good quality review papers on the state-of-the-art in the subject matters taken up in the workshop

- Formation of a regional committee for CoML

- Strengthening of co-operation within the region through the establishment of a network

Venue and date

Goa, India. Tentative period November-December 2003

Organizing committee

Dr. M. Wafar, National Institute of Oceanography, Goa (chair)
Shubha Sathyendranath, POGO
Ron O'Dor, CoML
William Erb, IOC
Dr. Greg Wagner, University of Dar-Es-Salaam, Tanzania
Mrs. Ruby Pillay, Mauritius Oceanography Institute
Prof. Thomas Malone, Co-Chair, COOP

Budget

Financial support required from Sloan Foundation

1. Preparation for the workshop	7,000 US$
2. Participation of 25 scientists and invited experts (from India and abroad)	28,000 US$
3. Local arrangements and conference expenses	7,000 US$
4. Printing of proceedings / report	3,000 US$
Total	45,000 US$

Financial support expected from IOC regional office, Perth

1. Participation of 10 scientist/invited experts	10,000 US$

Role of POGO

The role of POGO is primarily that of facilitator. Dr. Sathyendranath, Executive Director of POGO, will be a member of the Organizing Committee and will assist Dr. Wafar in planning and organizing the meeting. POGO will administer the grant from the Sloan Foundation, if this application is successful. POGO will also ensure adequate POGO representation at the meeting.

Role of NIO

NIO shall contribute to the workshop in the following forms

- Dr. Wafar, NIO, will provide time and expertise to organize the workshop. He will also collate and edit the proceedings of the workshop.
- NIO will provide logistical and infrastructure support for the workshop.

Workshop report

Steps will be taken to have the proceedings published in *Indian Journal of Marine Sciences* with the Chair, Organizing committee as guest editor. He will be supported by a regular staff of the journal against a financial compensation for the time spent.

Time schedule

April 2003: Draft proposal to be examined by POGO
April 2003: Formal submission of the proposal to Sloan Foundation
May-June 2003: Confirmation of the workshop date and schedule, beginning of local organization, Confirmation of participants, assistance to them in identifying their contributions to the workshop activities, preparation of the background paper
July –August 2003: Receipt of contributed papers from participants, draft project proposals for discussion in the workshop.
Sep-Oct 2003: Initial review of contributed papers and draft proposals by the Organizing committee and experts, final preparation of the workshop.
Nov – Dec, 2003: Conduct of the workshop.
Jan – March, 2004: Draft report of workshop proceedings. Receipt of final papers from participants.
April - May 2004: Publication of the proceedings as a special issue of *Indian Journal of Marine Sciences* and the full report of the workshop.

Tentative Themes and speakers

- Why study Marine Biodiversity
  Ron O'Dor
- Links between Biodiversity and Ecosystem Functions
  Shubha Sathyendranath
- Coastal and Marine Biodiversity in the IOGOOS context
  William Erb
- Coastal and Marine Biodiversity in the COOP context
  Tom Malone
- Review of growth of Coastal Marine Biodiversity studies in the Indian Ocean region
  J.R.B. Alfred

Species perspectives

Biodiversity of:

- Coastal
  John Keesing
- Oceanic
  KKC Nair
- Deep sea
  Baban Ingole / Koslow
- Mangroves
  Kathiresan
- Corals
  Carden / Andrew Hayward
- Estuaries
  To be determined
- Seamounts
  Keith Sainsbury

Regional perspectives

- Gulf region
  Sayed Bukhari / ROPME representative
- Africa Coast
  Rabenawanana /Micheal Samways /Tony Ribbink
- India
  Mohideen Wafar ?
- Islands
  Chantal Conand
- Far east
  Swe Thwin
- Australia
  Chris Simpson

Cross-cutting themes

- Participatory monitoring
  Greg Wagner
- Parataxonomy
  ? Carden
- People's biodiversity registers
  Madhav Gadgil
- Remote sensing
  Mervyn Lynch / Shailesh Nayak
- Tools of taxonomy
  CSIRO
- Databases
  Radhakrishnan
- Issues of species conservation
  Vivek Menon / Lal Mohan

It may be noted that the organization of the topics for presentation have been grouped in such a way that, the biodiversity concerns could be addressed both from ecosystem perspectives as well as regional perspectives. The latter, instead of national perspectives, is being introduced here to emphasize that there is a need to look at biodiversity in a context that goes beyond national boundaries and that there is a strong need to foster regional co-operation and ease of information and data exchange between countries of the region. The cross-cutting themes, such as participatory monitoring and parataxonomy, have been introduced taking into consideration the needs expressed by scientists and other stakeholders.

Provisional list of participants

Ron O'Dor, CoML
Shubha Satyendranath, POGO
William Erb, IOC
J.R.B. Alfred, India
Tom Malone, USA

John Keesing, Australia
KKC Nair, India
Baban Ingole, India/Tony Koslow, Australia
Kathiresan, India
Carden Wallace/Andrew Hayward, Australia
CSIRO, Australia for IT based on taxonomy
Dr. Vivek Menon /Dr. Lal Mohan, India
Keith Sainsbury, USA

Sayed J Bukhari, Qatar or a representative from a ROPME country
Rabenawanana, Madagascar/ Micheal Samways orTony Ribbink, South Africa
Mohideen Wafar, India
Chantal Conand, Reunion
Swe Thwin, Myanmar
Chris Simpson, Australia

Greg Wagner,Tanzania
Madhav Gadgil, India
Mervyn Lynch, Australia
Shailesh Nayak, India
K. Radhakrishnan, India

Abdallah Fatouma, Comoros
Nicole Gravier Bonnet, Reunion
Chloe Bourmaud, Reunion
Sonia Ribes, Reunion
Tris Wooldridge, South Africa
Somchai Bussarawit, Thailand
Shahid Amjad, Pakistan

Representative of CoML Sub-Saharan Africa Initiative
Representative of CoML Australia Initiative

DRAFT AGENDA

Day 1

08:30 – 09:00 Welcome of participants by the Chair of the Organizing Committee, CoML Representative and POGO Representative.

09:00 – 10:30 Why study Marine Biodiversity - Ron O'Dor

Links between Biodiversity and Ecosystem Functions - Shubha Sathyendranath

Indian Ocean context – William Erb

Review of growth of Coastal Marine Biodiversity studies in the Indian Ocean region – J.R.B. Alfred

10:30 – 11:00 Coffee Break

11:00 – 12:30 Ecosystem perspectives

Biodiversity of:

- Coastal
- Oceanic
- Deep sea

12:30 – 14:00 Lunch

14:00 – 15:30 Ecosystem perspective (Contd.)

Biodiversity of:

- Mangroves
- Corals
- Estuaries
- Others

15:30 – 16:00 Coffee Break

16:00 – 17:30 Regional perspectives

- Gulf region
- Africa Coast
- India

Day 2

09:00 – 10:30 Regional perspectives (Contd.)

- Islands
- Far east
- Australia

10:30 – 11:00 Coffee Break

11:00 – 12:30 Cross-cutting themes

- Participatory monitoring
- Parataxonomy
- People's biodiversity registers

12:30 – 14:00 Lunch

14:00 – 15:30 Cross-cutting themes (Contd.)

- Remote sensing
- Tools of taxonomy
- Databases
- Marine species conservation issues

15:30 – 16:00 Coffee Break

16:00 – 18:00 Break into Working Group Discussions

Day 3

09:30 – 10:30	Presentation of Discussions of recommendations from the working groups Writing Assignments
10:30 – 11:00	Coffee Break
11:00 - 12:30	Writing of Recommendations
12:30 – 14:00	Lunch
14:00 – 15:30	Writing of Recommendations
15:30 – 16:00	Coffee Break
16:00 – 17:30	Compilation of the recommendations Outline the next course of action; closing

DRAFT LETTER OF INVITATION

Dear

With support from the Census of Marine Life (CoML), Intergovernmental Oceanographic Commission (IOC) and the Partnership for the Observation of the Global Oceans (POGO), we are planning to hold a workshop on coastal and marine biodiversity of the Indian Ocean in November-December 2003. This regional workshop would include participants drawn from Indian Ocean Rim countries and experts from outside the region.

Consistent with the goals of CoML, this workshop would focus on what is known, unknown and unknowable of the coastal and marine biodiversity of the Indian Ocean. The expected outcomes of the workshop would be:

1. Synthesis of the status of current knowledge on the biodiversity across the Indian Ocean countries.
2. Identification of the gaps and measures to fill up these.
3. Identification of promising areas of research and development.
4. Identification of new tools for development.

Needless to say, synergising our current research efforts and fostering a better co-operation between the countries of the region is an implicit goal.

The design of the workshop is a mix of presentations and group discussions that would lead to fulfilling the objectives stated above and also identifying new projects and new tools as means. In addition, there would be group discussions with CoML, POGO and IOGOOS representatives on how to link the proposed programs with other ongoing initiatives. It is expected that the entire proceedings would be published in a special issue of Indian Journal of Marine Sciences.

I would appreciate if you could agree to participate in the workshop and help us achieve the goals we have set out. The organizing committee would be pleased to support your travel cost and living expenses.

With best wishes

Yours sincerely