

## MARINE BIOLOGY AND COMPUTERIZATION

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Almost 71% of the earth's surface is covered with the sea water which, harbours rich and diversified biota. Sustainable exploitation of these living resources needs proper, adequate, up-to-date and constant flow of information on various aspects of marine environment. Accessed information needs to be analysed in various ways for interpretation and prediction, which is essential for development and management. Computerization has vital role to play in the basic and applied aspects of marine biological data. An attempt is made here to review the state of computerization in marine biology. It also highlight the areas and aspects which are of utmost importance for sustainable development of living resources but still not being properly documented and archived.

### INTRODUCTION

The concept of exploitation and utilization of marine living resources is in vogue all over the world, for centuries together. Ever increasing exploitation of these resources; exponentially increasing levels of various pollutants and endless pressure of human population have caused threat to the diversified marine life forms. Major cause for such near helpless situation is non-availability of, desired information, tools of analysis, modelling, interpretation, forecasting as well as storage and retrieval of information. This emphasizes the role of computerization in marine biology and biological oceanography.

### COMPUTERIZATION IN MARINE BIOLOGY

It is only in early 60's, after realising the relevant application of computer science and information technology in managing the

marine living resources, the United Nations (UN) encouraged the activities initially through its various programmes and later on through the InterGovernmental Oceanographic Commission (IOC). Since then lot of development has taken place in this field.

Activities of computerization and information technology together in marine sciences could be classified as follows;

1. Monitoring of Marine Environment
2. Database Management
3. Information Retrieval
4. Information Analysis, interpretation and modelling
5. Familiarization and training of potential users.

### MONITORING OF MARINE ENVIRONMENT

Monitoring of the marine ecosystems becomes essential due to its potentials and

increasing demands. Traditionally monitoring of marine environment is taken care of through manned expeditions, metering stations, and research vessels. However, development of automated monitoring systems, in the form of buoys started providing researchers accurate and real-time data. Wide range of sensors developed for such buoys facilitate to monitor biological parameters like nutrient concentration, chlorophyll, algal content and fish shoal movements. These buoys are linked with various satellites and also with coastal monitoring stations. Remote sensing satellites like NIMBUS, GOES, LANDSAT, SPOT, SEASAT, also monitor the marine environment constantly.

### **DATABASE MANAGEMENT**

It is much a realised fact that the available data on marine life are scattered and hence prevent access to desired information, at times. Hence, proper collation of data in speedy retrieval form becomes necessary. Appraisal of the presently available databases suggests that only 1% of the databases are related to marine biology. About 60% of these databases are bibliographic or directory type in nature. This emphasizes need for growing number of numeric, textual, alpha-numeric, multimedia and expert data sources. Areas like systematics, biodiversity, ecology, biogeography and environmental impact assessment are of high potential for application of recent databases to development, diversification and management of marine living resources.

Databanks need to have ability to sort and combine data into formats required for large-scale statistical analysis and modelling.

### **INFORMATION RETRIEVAL**

In order to satisfy information needs of researchers, planners, environmentalists and common people too; efficient online and

offline ways of retrieval and dissemination of data become imperative. Emergence of computer-based telecommunication and satellite links has served this purpose to great extent at least for developed nations. In developing and under developed nations distributed information systems still seems to be the effective way of data transfer. Active communication network needs to be functioning in the Third World.

### **INFORMATION ANALYSIS, INTERPRETATION AND MODELLING**

Proper interpretation of available data depends on appropriate analytical tools. Range of statistical, modelling/forecasting softwares are available. Since majority of them are general purpose packages, they do not satisfy the needs of interpreter, and analysts to carry out particular purpose and function. Moreover, much time needs to be wasted in understanding the functioning of these packages. This greatly retards the analysis, processing modelling and data based functions. Development of customer oriented softwares of comprehensive nature would be of much use for conservation and sustainable use of resources. Latest techniques like Geographical Information System (GIS) needs to be popularised amongst marine biologists.

### **FAMILIARIZATION AND TRAINING OF POTENTIAL USERS**

Spreading information culture and thereby inducing potential users to use latest techniques in computer science and information technology has become imperative. This would also lead to developing authentic data sources in marine biology. United Nation's initiative through TREDMAR (Training and Education in Marine Sciences), COMAR (Coastal Marine Programme) and PROMAR (Promotion of Marine Sciences) programmes has achieved substantial success in this regard. But much

needs to be done in this field.

## BIOINFORMATICS : A TOOL FOR MARINE BIOLOGISTS

Bioinformatics, an area of interaction between computer science and information technology with biology including biotechnology has really boosted a level of computerization in biological oceanography (Fig. 1). Much advancement has been done in the field of marine bioinformatics in just a span of two decades since its emergence in early 80's.

Many new datasources as well as statistical packages have been developed for marine biologists. Few of them to quote here are databases like "*Global Biodiversity Database*" of Expert Centre of Taxonomic Identification (ETI), Amsterdam, The Netherland and "*FishBase*" of International Centre for Living Aquatic Resources Management (ICLARM), Phillipines. Whole range of softwares developed by ICLARM is also a example of subject dedicated programmes. Many new monitoring systems such as SASEA, SEAWATCH AND ODAS are constantly monitoring our marine environment and its living resourses.

## MARINE BIOINFORMATICS : INDIAN SCENE

Though the formation of Bioinformatics Centres in India has paralleled with those established in Europe and North America during 1985-87; marine bioinformatics is rather a late starter. It is only in early 1990, Bioinformatics Centre For Marine Biology and Marine Biotechnology was established at the National Institute of Oceanography, Goa under the "*Biotechnology information System (BTIS)*" programme of the Department of Biotechnology, Government of India, New Delhi. Within the short span of less than four years this Centre has been recognised world wide for its efforts, experience and expertise in the field of

marine bioinformatics. Databases developed by the Centre have come for recognition, both nationally and internationally. Centre has also taken up the task of computerizing systematics, which was neglected during last few decades but is in anvil due to emerging promises of R & D in marine biotechnology, especially, mariculture and bioactivity.

Other than this, in the field of marine environmental monitoring, country has achieved substantial success due to its space application programmes and the launching of 14 satellites since 1975. Successful experimentation of APPLE satellite in 1981 has really improved the communication in the country and lead us on par with the many developed nations. Major Indian satellite-telecommunication networks like NICNET, I-Net, INDONET are just step away from reaching every nook and corner of the country.

On the front of marine biology related software development much needs to be done. This is inspite of the fact that country has been recognised as one with vast potential for sophisticated software development. Lack of interaction between subject experts and software developers may be the major reason for this present state in the Country.

Similarly much more needs to be done in expertising the potential users. Successful and sustainable exploitation of marine living resources from our 2.1 million sq. km. EEZ; depends much on how best we could develop the information culture amongst all concenered. Our success in this area will not only lead us to achieve the target of sea food for everyone but also to attain sustainable utilization and management of marine living resources for drugs, pharmaceuticals, control of deterioration and containment of pollution, all through the powerful tools of marine biotechnology.