

SDNP - ENVIS

Newsletter



Estuaries, Mangroves, Coral Reefs and Lagoons

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<http://casmbenvis.nic.in/sdnp/index.htm>

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Editorial

Hello Readers,

The ENVIS (Environmental Information System) newsletter on estuaries, mangroves, coral reefs and lagoons has come in different dimensions over the period of time covering various facets of the coastal and marine ecosystems. That way it plays an important role in the dissemination of information to the scientific community. Recently the Ministry of Environment and Forests has selected our Centre as one among the 20 SDNP (Sustainable Development Networking Programme) Systems to strengthen the existing ENVIS Centre in the field of Marine Ecosystems. Through the SDNP networking system, the ENVIS Centre has been bringing out special newsletters.

The article appearing in this issue explains the advantages of multidisciplinary approach for studying marine biology and biotechnology through development and application of marine bioinformatics. This issue also carries recent news in the field of research. Apart from reading, the users can contribute articles to our ENVIS newsletter "Seshaiyana".

Prof. T. BALASUBRAMANIAN
Prof. S. AJMAL KHAN

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ENVIRONMENTAL INFORMATION SYSTEM CENTRE
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MULTIDISCIPLINARY APPROACH FOR STUDYING MARINE BIOLOGY AND BIOTECHNOLOGY THROUGH DEVELOPMENT AND APPLICATION OF MARINE BIOINFORMATICS

Introduction

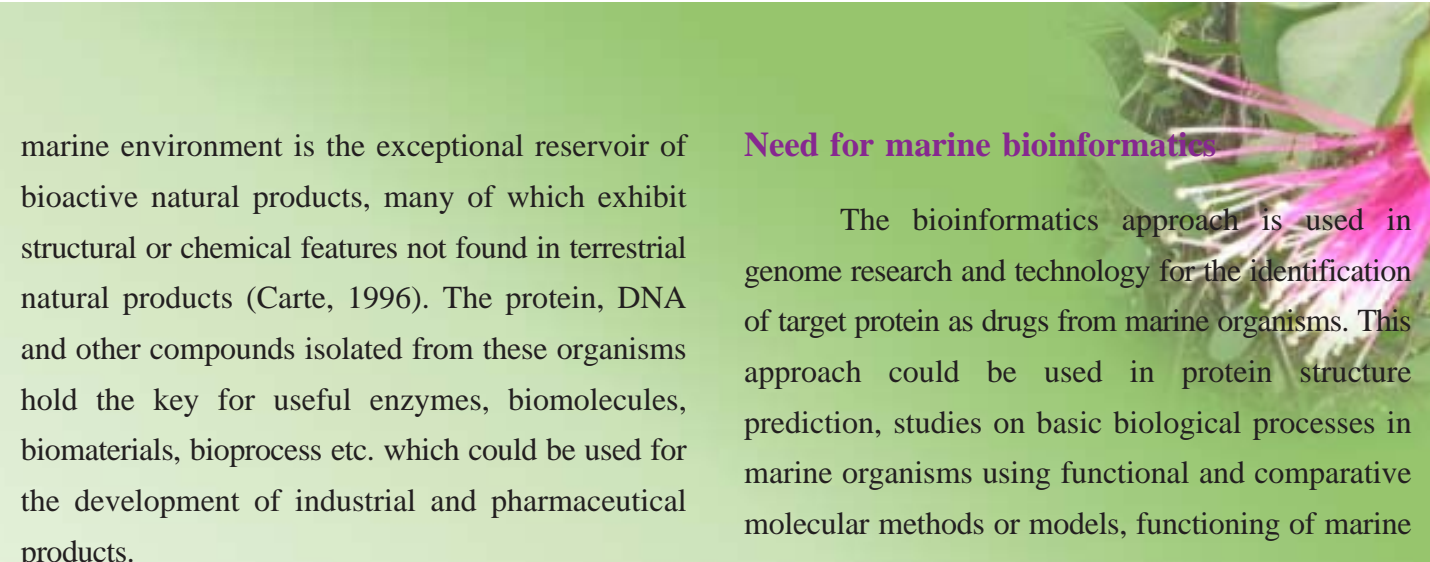
Bioinformatics forms the basis for biotechnology, since most of the biotechnological innovations are inevitably dependant on bioinformatic applications. The bioinformatics field has grown astoundingly during last decade due to the advancement in biotechnology combined with the development of computational skills and effort by different countries in sharing information though internet by using the power of algorithms. Even in today's technological world no man-made structure is as complex as the biological system. Thus the foremost aim of bioinformatics is solving complex biological problems i.e. from molecular biology to physiological processes through exchange of databases. The perspectives of biology starting from systematic classification of organisms to genomics and proteomics are constantly progressing due to the availability of various high-tech software tools and databases for bioinformatics. New insights are often made with these tools to explore molecular biology through the logics of computation. There are many biological databases available for genomics and proteomics and unfortunately none of the major databases are of Indian origin. Thus most of the required databases used and accessed are of foreign origin.

In India, due to IT (Information Technology) revolution and development of biotechnological applications, bioinformatics is considered a highly developing field as it combines both these fields.

Contributions in the field of proteomics and genomics by the Indian scientists are significantly increasing in the recent years. Hence there is a need for the development of separate databases of Indian origin. Of late bioinformatics is increasingly being used in marine research. This article discusses the scope of multidisciplinary approach for studying marine biology and biotechnology through the development of marine bioinformatics applications in the global and Indian context.

Life in marine environment

About 70% of our planet Earth is covered by Oceans with 1370.323 million cubic km of water. Therefore oceans influence the climate of entire planet. The water in the ocean is a rich medium with lot of unique properties and supports 90 % of world's living biomass. Marine environment provides various biotopes and niches to a wide variety of organisms living from the intertidal region to abyssal depth and from the top layers of the water to the bottom. Marine organisms living in Ocean's vast three dimensional space are adapted to varying physicochemical conditions ranging from low to high saline, freezing to very high temperatures (hydrothermal vents), normal to extreme pressure at depths and normal light regimes to complete dark in deep sea, normal oxygen to methanogenic environment (gas hydrates) etc. These diverse marine organisms living in normal to extreme environments (extremophiles) have useful characteristics yet to be discovered from their wide array of biomolecules. The



marine environment is the exceptional reservoir of bioactive natural products, many of which exhibit structural or chemical features not found in terrestrial natural products (Carte, 1996). The protein, DNA and other compounds isolated from these organisms hold the key for useful enzymes, biomolecules, biomaterials, bioprocess etc. which could be used for the development of industrial and pharmaceutical products.

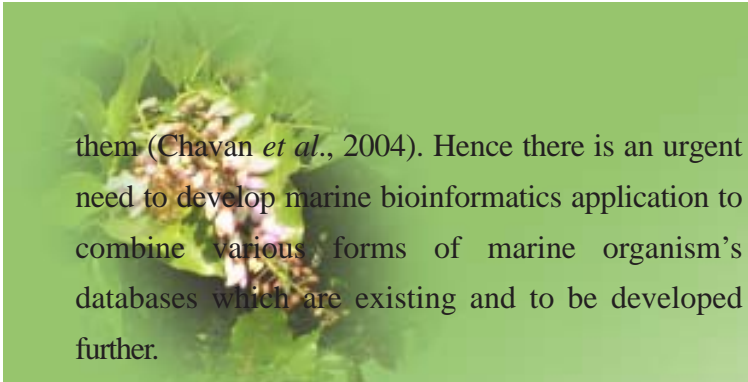
Marine bioinformatics

The bioinformatics which developed since the eighties is defined as “the scientific discipline that encompasses all aspects of biological information acquisition, processing, storage, distribution, analysis and interpretation”. It combines the tools of biology, chemistry, mathematics, statistics, and computer sciences to understand life and its processes. The term Marine Bioinformatics refers to “the use of computer and networking technologies to gather, store, integrate, analyse, interpret and disseminate all data pertaining to the distribution, description, systematic classification, phylogeny, behaviour, physiology, biomolecular structure and sequence data of marine organisms along with the functional aspects” (Vinithkumar, 2004). Marine bioinformatics includes marine genomics and marine proteomics. Marine genomics refers to any attempt to analyze or compare the entire genome complement of a species of marine origin. Similarly marine proteomics is the study of protein family derived from marine organisms. The proteome is derived from PROTEin complement of the genOME. Proteomics is concerned with qualitative and quantitative studies of gene expression at the level of the functional proteins themselves.

Need for marine bioinformatics

The bioinformatics approach is used in genome research and technology for the identification of target protein as drugs from marine organisms. This approach could be used in protein structure prediction, studies on basic biological processes in marine organisms using functional and comparative molecular methods or models, functioning of marine biological ecosystem and development of aquaculturally important species through gene manipulation etc.

As the volume of databases for biomolecules, proteins and genes of various land and marine organisms is growing amazingly, analyzing the data and getting required results for marine organism from the common database for land, air and water are increasingly becoming complex. Hence, there is a need for separate database for storing, retrieving and analysis of marine organisms, which would reduce much time for students and scientists undertaking data mining. It will also be helpful in speedy comparison of results with the other organisms. Thus instead of having combined databases (protein, gene or other biomolecules databases) for all organisms from different environments, the databases could be compartmentalized based on the environment and geographical boundaries they live and these databases could be linked or integrated with one another. Since effort is limited, many of the species in marine environment are yet to be discovered. However, the collected data and information regarding marine organisms remain distributed with several organizations and individuals, making it difficult to access easily and efficiently adequate and accurate information about



them (Chavan *et al.*, 2004). Hence there is an urgent need to develop marine bioinformatics application to combine various forms of marine organism's databases which are existing and to be developed further.

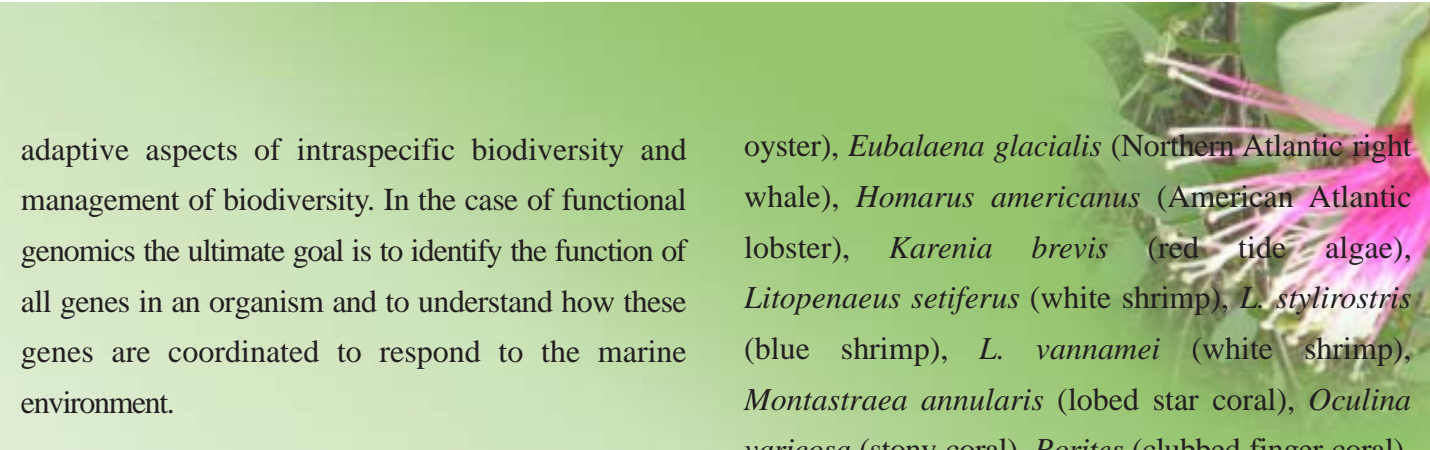
International and Indian programmes on marine bioinformatics

The successful sequencing of entire human genome in the Human Genome project opened up our understating on biological systems in an unprecedented way. This was made possible due to the advancement in molecular biotechnology combined with information technology. For searching natural bioactive molecules from marine organisms for use as potential drugs, bioinformatics offers good tools to step up the discovery. Without bioinformatics, new application oriented research in many fields of marine drug discovery and marine biology would come to a standstill. Globally many pharmaceutical companies are looking for potential drugs from extremophilic marine organism as the sea has extreme conditions like, high pressure in deep sea, high temperature about 350°C in hot hydrothermal vents, deep cold conditions in the depth of the oceans, higher saline conditions in some places and anoxic conditions in the sediments and water column, higher poisonous dissolved and solidified (gas hydrates) gaseous sedimentary conditions. Recently the European Network of Excellence (NoE) (mainly devoted to marine genomics) was launched. Using this, many of the European, US and Japanese universities and companies in Europe, United States and Japan are working on various aspects of marine biotechnology.

India was the first country in the world to establish a distributed Biotechnology Information System Network (BTIS net) in 1987. This was done by the Department of Biotechnology (DBT, Government of India) to create an infrastructure that enables the scientific community to solve biotechnology problems through the application of bioinformatics. To integrate the national resources and to promote tandem research, the department has also established a high speed and large bandwidth network in the form of Biogrid India to act as a knowledge pathway for discoveries in biotechnology. In addition to this many of the Ministry of Environment and Forests (Annual Report, 2004-2005) sponsored Environmental Information System (ENVIS) Centres set up in various universities and other institutions, besides the Agricultural Research Information Network (ARISNET) are concentrating on different issues related to biodiversity informatics (Chavan *et al.*, 2005). Apart from this, National Institute of Ocean Technology under the auspices of Ministry of Earth Sciences (MoES) has initiated activities in marine bioinformatics by establishing a Marine Bioinformatics Centre (Vinithkumar, 2004).

Application of marine genomics

The marine genomics is applied in three different areas viz., (a) Comparative genomics – the study of representative marine organisms across the different phyla of life, (b) Functional genomics - for the exploration of complex relationships between stimuli and gene expression and (c) Environmental genomics - the delineation of structure and dynamics of biodiversity in marine ecosystems, including microbial diversity and ecology, the functional and



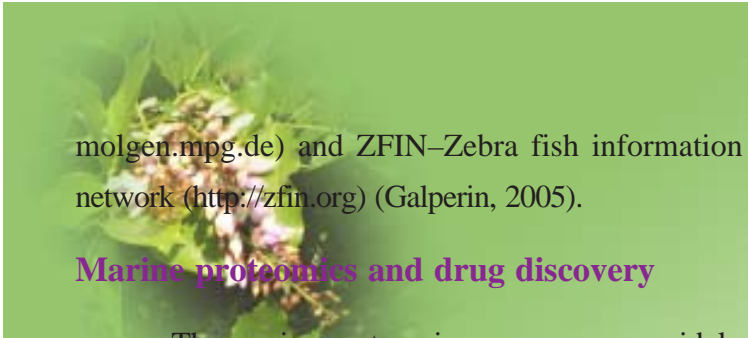
adaptive aspects of intraspecific biodiversity and management of biodiversity. In the case of functional genomics the ultimate goal is to identify the function of all genes in an organism and to understand how these genes are coordinated to respond to the marine environment.

Functional genomics involves use of a new technology, called DNA micro arrays, or DNA 'chips', to monitor the level of gene products of nearly all the genes in a tissue on a single chip so that researchers can have a better picture of the interactions among thousands of genes simultaneously. While chips measure the level of gene products, the DNA sequencing is performed to fabricate the chips also to identify normal genes and novel gene mutations. The gene expression studies using DNA micro arrays are being used to study the characteristics of land and marine organisms so also humans.

DNA micro array technique is being increasingly used to study the commercially important coastal aquaculture species and for the development of new drugs. In this context, the Marine Genomics project is a functional genomics initiative developed to provide a pipeline for the curation of Expressed Sequence Tags (ESTs) and gene expression micro array data for marine organisms. It provides a unique clearing-house for marine specific EST and micro array data and is currently available at <http://www.marinegenomics.org> (McKillen *et al.*, 2006). As of 2005, it contained 19 marine species databases (over 46,000 EST sequences) which included *Crassostrea gigas* (Pacific oyster), *Callinectes sapidus* (blue crab), *Crassostrea virginica* (eastern

oyster), *Eubalaena glacialis* (Northern Atlantic right whale), *Homarus americanus* (American Atlantic lobster), *Karenia brevis* (red tide algae), *Litopenaeus setiferus* (white shrimp), *L. stylirostris* (blue shrimp), *L. vannamei* (white shrimp), *Montastraea annularis* (lobed star coral), *Oculina varicosa* (stony coral), *Porites* (clubbed finger coral), *Squalus acanthias* (spiny dogfish) and *Tursiops truncatus* (bottlenose dolphin) etc., that are maintained by registered users from local and remote locations in Europe and South America in addition to the USA. Analysis tools implemented include a pipeline upload tool for EST FASTA file, sequence trace file and micro array data, an annotative text search, automated sequence trimming, sequence quality control (QA/QC) editing, sequence BLAST capabilities and a tool for interactive submission to GenBank. Another feature of this resource is the integration with a scientific computing analysis environment implemented by MATLAB (McKillen *et al.*, 2006).

The nucleic acids of wide variety of organisms are analysed to understand the mechanisms involved in protein synthesis and subsequent downstream processes. The Nucleic Acids Research Molecular Biology Database Collection is a public online resource freely available to the public. The 2005 update includes 719 databases (Galperin, 2005). The database list and summaries are available online at the Nucleic Acids Research web site (<http://nar.oupjournals.org>). Among the database list provided, very few are found to be of marine based research e.g. GeneNest–Gene indices of human, mouse, zebra fish, etc. - (<http://www.genenest>.



molgen.mpg.de) and ZFIN–Zebra fish information network (<http://zfin.org>) (Galperin, 2005).

Marine proteomics and drug discovery

The marine proteomics resources are widely scattered. The protein structural database, the protein data bank (PDB) contains about 37,000 structures as of 2007. PDB itself contains many structure files of proteins derived from marine organisms. The protein structural database is growing at an enormous speed with a total count going above 37,000 molecules and the rate of deposits per year is also increasing very rapidly. This is going to be one of the burgeoning fields in molecular biology, to find out answer for different diseases using various tools and databases which are already finding their applications in drug industries. Marine organisms like sponges, corals, sea weeds and starfish etc. have various bioactive properties like antibacterial, antifungal and antiviral which can be used as a potential drug target. Thus bioinformatics could be widely used for predicting the potential activities of marine drugs.

Tools and databases for marine bioinformatics

Many software tools are available, which include Blast, Cn3D, Swiss PDB viewer, Hex, Vega, Bioeditor, Bioviewer, Protein explorer, Chime, Rasmol, Emboss etc., based on different operating systems like Linux and Windows. Hundreds of such software tools available for bioinformatics could be used very well. There are many databases which also include the marine based molecular sequences and some of them are NCBI, EMBL, DDBJ, PIR, GenBank, KEGG etc. The NCBI web (National

Center for Biotechnology Information) which includes GenBank, PubMed also contains information regarding nucleotides and protein sequences of marine organisms.

The GenBank includes the sequences of marine bacteria, fungi, virus, plants, invertebrates and vertebrates. These are kept with corresponding protein and gene records and hints to other NCBI database. GenBank is a comprehensive database that contains publicly available DNA sequences for more than 1,65,000 named organisms (Benson *et al.*, 2005). GenBank also contains large number of DNA sequences of marine organisms. In addition to maintaining the GenBank nucleic acid sequence databases, the National Center for Biotechnology Information (NCBI) provides data retrieval systems and computational resources for the analysis of data in GenBank and other biological data made available through NCBI's website (Wheeler *et al.*, 2005).

Protein Data Bank (PDB) contains more than 37,000 worldwide repository macromolecules structural data which include protein sequences and structures of many marine organisms. Also, complete or partial genome sequences of some marine invertebrate organisms such as sea urchins, shrimps and molluscs are available in the net and many are in the pipeline (<http://www.marinegenomics.org>).

The Micro-Mar database of marine microbial genome (<http://egg.umh.es/micomar>) has been recently created to collect information on DNA diversity of marine prokaryotes for biographical and ecological analyses. The database currently includes 11,874 sequences corresponding to high resolution taxonomic genes (16s rRNA, ITS and 23s rRNA) and many

other genes including CDS of marine prokaryotes together with available biogeographical and ecological information.

Application of marine biodiversity informatics

Computer aided taxonomy (CAT) is getting importance due to the endless necessity for the proper identification of species. Over 50 million species are projected to exist on the Earth and about 1.5 million species are known to us so far (Chavan *et al.*, 1995). In order to conserve the living resources, a thorough understanding and identification of individual species and its role in ecology are imperative. Wheeler *et al.* (2004) acknowledged with a cautious stance that the world wide web presents a perfect medium for exploring how to undertake collaborative taxonomic studies. Specialized online software such as digital libraries of biodiversity literature is being developed to collect and show the details of a species or a group of organisms from different websites or databases in a single query page. Thanks to the efforts taken, environment based biodiversity databases have been developed which include marine biodiversity databases such as Global Biodiversity Information Facility (GBIF; <http://www.gbif.org>), Census of Marine Life (CoML; <http://www.coml.org/colm.htm>), Indian Ocean Census of Marine Life (IO-CoML), Ocean Biodiversity Information System (OBIS; <http://www.obis.org>), Indian Ocean Biogeographic Information System (IndOBIS; <http://www.indobis.org>) etc.

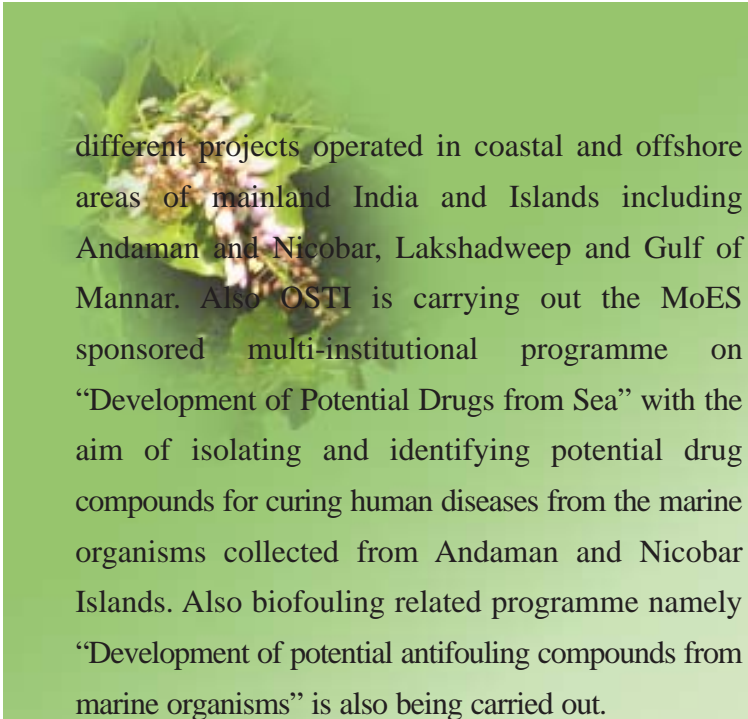
OBIS is a component of the Census of Marine Life (CoML) an International program to assess and explain the diversity, distribution and

abundance of marine life (Grassle, 2000). OBIS is an online service provider of global georeferenced information on accurately identified marine organisms. European Register of Marine Species (ERMS) is a register of marine species occurring in Europe to facilitate marine biodiversity research and management (www.erms.biol.soton.ac.uk). It is having a checklist of over 29,000 species of marine fauna and flora recorded in Europe (Costello, 2000). Fautin (2000) assembled the database on sea anemones of the world from primary literature, which contains all definitive lists of nominal species, each in its original binomen, with full bibliographic citation and associated data. Even the most popular “Google Earth” software is also integrating the biodiversity information in their Geographical Information System (GIS) based layer.

In order to catalogue the marine species available in India, National Chemical Laboratory, Pune has initiated excellent work on marine biodiversity information. The collection in IndOBIS provides information about 35,000 marine species (www.ncbi.org). Also efforts are underway to catalogue the specimens available in Indian museum. For this a special software namely “SAMPADA” has been developed by NCL (Chavan *et al.*, 2005). Also National Institute of Oceanography (NIO) is involved in carrying out the Indian part of Census of Marine life project.

Marine Bioinformatics Center (MBiC) of NIOT

In the ongoing program of Ocean Science and Technology for Islands (OSTI) in NIOT, data on biological, ecological, biodiversity, biochemical and biomolecular aspects are being collected through



different projects operated in coastal and offshore areas of mainland India and Islands including Andaman and Nicobar, Lakshadweep and Gulf of Mannar. Also OSTI is carrying out the MoES sponsored multi-institutional programme on “Development of Potential Drugs from Sea” with the aim of isolating and identifying potential drug compounds for curing human diseases from the marine organisms collected from Andaman and Nicobar Islands. Also biofouling related programme namely “Development of potential antifouling compounds from marine organisms” is also being carried out.

During the process of collecting and cataloguing marine organism for the above purposes, biodiversity data are being compiled in the form of database using marine bioinformatics approach. Also in support of laboratory research, various molecular biology databases on protein, gene and other biomolecules are being exploited with the open source database and software available through internet.

In the backdrop of above, in order to store, retrieve, process and disseminate data, the Marine Bioinformatics Centre (MBiC) was set up as first of its kind in India, as the supporting facility for the ongoing programmes of OSTI of NIOT during July 2003. MBiC is integrating the four subject areas such as (1) Biodiversity and taxonomy of marine organisms, (2) Software and molecular databases for marine organism, (3) Laboratory studies on marine genomics and proteomics and (4) Marine environment. MBiC is planning to serve as one of the linking points for other institutions working in similar areas in India and abroad. The biology related information collected is being updated and made

available for all user agencies with or without restriction, based on the importance of the data to OSTI and other sponsoring agencies. The selective distribution of database will serve the public as well as students and scientific community working in the areas of marine biology, biotechnology and bioinformatics. Based on the experience gained from different projects, OSTI is also conducting short term, wet-lab training programme for the students, researchers and lecturers of various institutions. The MBiC site can be visited with the link: <http://www.niot.res.in:82/mbic/index.html>.

Conclusion

The prospects for the development of marine bioinformatics in India are remarkable. Since potential drugs and other bioactive molecules could be located from the marine organisms, there is a need to develop separate databases for proteomics, genomics along with taxonomy of marine organisms which could be useful in comparing the land based organisms by interlinking different environment based databases. Thus the time has come for developing marine bioinformatics applications in India as rapid strides are made at the international level.

Acknowledgements

The author thanks Dr. S. Kathioli, Director, National Institute of Ocean Technology (NIOT), Dr. R. Venkatesan, Group Head-Ocean Science and Technology for Islands (OSTI) and authorities of Ministry of Earth Sciences (MoES) for constant support and encouragement provided to the OSTI for the development of Marine Bioinformatics Center.

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RECENT NEWS IN BRIEF

Many large cities at risk due to rising seas

More than two-thirds of the world's large cities are in areas vulnerable to global warming and rising sea levels, and millions of people are at risk of being swamped by floods and intense storms, according to a new study. In all, 634 million people live in the threatened coastal areas worldwide - defined as those lying at less than 33 feet above sea level - and the number is growing, said the study published in the journal *Environment and Urbanization*. More than 180 countries have populations in low elevation coastal zones, and about 70 percent of those have urban areas of more than 5 million people that are under threat. Among them are New York, Mumbai, Dhaka, Jakarta, Shanghai and Tokyo. The peer-reviewed scientific study said it is the first to identify the world's low-lying coastal areas that are vulnerable to global warming and rising sea levels. It said 75 percent of people living in vulnerable areas are in Asia, with poorer nations most at risk. For more information log on to <http://www.news.yahoo.com>; www.eucc.net/en/news.

1 Billion people under threat of sudden sea level surges

More than 1 billion people live in low-lying areas where a sudden surge in sea level could prove as disastrous as the 2004 Indian Ocean tsunami, according to a study presented on April 19, 2007. New mapping techniques show how much land would be lost and how many people will be affected by rapid sea level rises that are often triggered by storms and earthquakes, a US Geological Survey-led team

determined. E. Lynn Usery, who led the team, said nearly one-quarter of the world's population lives 100 feet (30 meters) below sea level - the size of the biggest surge during the 2004 tsunami that pulverized villages along the Indian Ocean and killed 2,30,000 people. The new mapping technique provides details which were previously not available enabling policymakers with better tools to prepare for potential disasters. With just a click on the mouse, researchers can gauge how much land would be lost at various places. The impetus for the project came due to the 2004 tsunami and Hurricane Katrina in 2005 which underlined the devastating impact sudden sea level surges can bring on those living in coastal areas. Even though people know that low-lying areas like the Netherlands or many parts of Asia are at risk of flooding, many do not realize just how big a risk they are facing. For more information log on to <http://www.planetark.com/dailynewsstory.cfm/newsid/41485/story.htm>; www.eucc.net/en/news.

Scientist says sea level rise can accelerate

Data from satellites show that melting of polar ice and the consequent sea level rises might be worse than what was thought earlier a leading oceanographer said on March 12, 2007. Eric Lindstrom, Head of Oceanography at the National Aeronautics and Space Administration (NASA) stated this on the sidelines of a global oceans conference in Hobart. "All indications are that it's going to happen faster." Rapid advances in science in the past five years on polar ice-sheet dynamics have yet to filter through into scientific models, Lindstrom said. He also pointed out the huge splits in Antarctic ice shelves in 2002 (which happens

once in-100-year) created icebergs bigger than some small countries. The mega icebergs were first thought not to affect global sea levels because the ice broke off from shelves were already floating on the surface of the ocean. But the disintegration of ice shelves that had blocked the flow of ice from the Antarctic continent could allow sudden flows by glaciers into the ocean, raising sea levels. For more information log on to <http://www.planetark.com/dailynewsstory.cfm/newsid/40821/newsDate/13-Mar-2007/story.htm>; www.eucc.net/en/news.

Acidic oceans threaten sea life

Rising carbon dioxide emissions are making the world's oceans more acidic, particularly closer to the poles, heralding disaster for marine life. This is one of the conclusions of the IPCC UN report. Harvey Marchant, Australian lead author of the report on polar regions said that a high up-take of carbon dioxide by polar oceans is producing marked changes in several species. Marchant, a former Head of Biology at the Australian Antarctic Division, said that Southern Ocean species are more susceptible because cold waters absorb more carbon dioxide than warmer waters. More the up-take of carbon dioxide the more acidic the ocean becomes, inhibiting calcium carbonate formation and leaving many important planktonic species such as pteropods, or sea snails, some algae and single celled animals which rely on calcium carbonate for their shells to develop vulnerable. Changes could also affect the chemistry of dissolved nutrients, potentially causing large-scale changes in marine ecosystems with a knock-on effect to other larger species, such as fish and squid that rely on these organisms to survive. Other recent

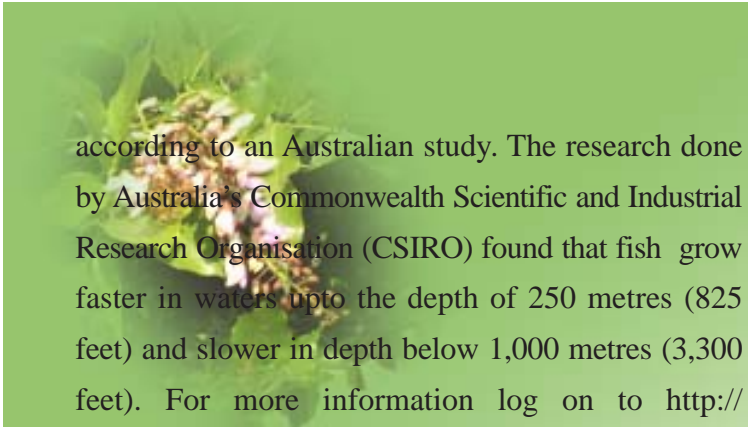
reports say corals and molluscs are also being affected increasingly by acidic oceans, disrupting the processing of calcium carbonate for their skeletons and shells. Marchant said that it was not known how long it would take for these effects to be reversed. For more information log on to <http://www.planetark.com/dailynewsstory.cfm/newsid/41282/story.htm>; www.eucc.net/en/news

Global warming driving Australian fish south

Global warming is starting to have a significant impact on Australian marine life, driving fish and seabirds south and threatening coral reefs, Australia's premier science organisation said on April 4, 2007. In particular, warmer oceans, changes in currents, disruption of reproductive cycles and mass migration of species would affect Australia's marine life, particularly in the southeast. Nesting sea turtles, yellow-fin tuna, dugongs and stinging jellyfish are examples of marine life moving south as seas get warm, said the report by the government-backed Commonwealth Scientific and Industrial Research Organisation. The report, "Impacts of Climate Change on Australian Marine Life", is the first major study in the Australian region to combine the research of climate modellers, ecologists and fisheries & aquaculture scientists. For more information log on to <http://www.planetark.com/dailynewsstory.cfm/newsid/41256/story.htm>

Fish growth enhanced by climate change

Climate change is affecting the growth of fish, with those living in warmer, shallow waters growing faster and species in cooler deep ocean growing slower,



according to an Australian study. The research done by Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) found that fish grow faster in waters upto the depth of 250 metres (825 feet) and slower in depth below 1,000 metres (3,300 feet). For more information log on to <http://www.planetark.com/dailynewsstory.cfm/newsid/41606/newsDate/30-Apr-2007/story.htm>; www.eucc.net/en/news

Noise scanner could save whales

Hundreds of whales and dolphins could be saved thanks to a new listening system designed by the Plymouth University. The equipment, which is towed behind a ship, scans for calls and songs to pinpoint their exact location. Scientists, presenting a prototype on April 24, 2007 hope that this equipment will become integral to seismic survey equipment. Conservationists think underwater explosions used in surveying could be behind the beaching of whales. This system uses marine microphones, or hydrophones, to scan the seabed, listening for whale and dolphin sounds which are then recorded on to a computer. These sounds are then analysed to tell seismic operators if there are whales and dolphins in the area. For more information log on to http://news.bbc.co.uk/2/hi/uk_news/england/devon/6587761.stm and www.eucc.net/en/news

Climate change sceptics say humans not to blame – the counterclaims

Some scientists continue to challenge mainstream opinion that humans are causing climate change. Here are some of the arguments of those who cast doubt on mankind's responsibility for climate change, and

beneath each, a response by the Hadley Centre of Britain's Meteorological Office (HCBMO), the official centre for climate change research is given.

1. *Temperatures dropped for several decades after 1945, despite rising carbon dioxide emissions*

HCBMO: Along with carbon dioxide, fossil fuels also release particles called aerosols, which cool the climate by reflecting sunlight. Aerosols dominated the warming effect of CO₂ prior to clean-air acts of the 1960s and 1970s.

2. *Carbon dioxide concentrations in the atmosphere lag temperature rises in an ice core record dating back 600,000 years.*

HCBMO: Over the past several hundred thousand years, changes in the earth's orbit around the sun led to temperature changes, which in turn affected CO₂ levels. Concentrations of CO₂ are higher than they had been during the past 600,000 years. The counter-effect is that human-induced increases of CO₂, such as factory emissions, have enhanced the greenhouse effect and led to warming.

3. *Changes in solar activity also produce good correlations with temperature change.*

HCBMO: There are many factors, which may contribute to climate change. Satellite measurements showed no big change in solar heating in the last three decades of the 20th century. CO₂ has been shown to cause most warming in the past 50 years.

4. *Rising temperatures in the second half of the last century have plateaued in the past 10 years.*

HCBMO: 1998 was extremely warm due to the weather anomaly El Nino warming the Pacific Ocean, and subsequent years were colder. Ten years is too short a period to see long-term trends. While the World Meteorological Organization says 1998 was the warmest year since records began 150 years ago, NASA says 2005 was warmer. For more information log on to <http://www.planetark.com/dailynewsstory.cfm/newsid/41227/story.htm>

Some of the world's leading meteorologists gathered in Madrid on March 21, 2007 said they do not have any doubt that humans are responsible for global warming. For their arguments log on <http://www.planetark.com/dailynewsstory.cfm/newsid/41001/newsDate/22-Mar-2007/story.htm>; www.eucc.net/en/news

Migratory birds and whales confused by warming

Birds, whales and other migratory organisms are suffering from global warming that puts them in the wrong place at the wrong time, a UN official told during the 166-nation climate talks on May 7, 2007. A warmer climate disrupts the biological clocks of migratory species including bats, dolphins, antelopes or turtles, said Lahcen el Kabiri, Deputy Head of the UN's Bonn-based Convention on Migratory Species. Many creatures are mistiming their migrations, or failing to bother as changes between seasons become less clear. The shifts make them vulnerable to heat waves, droughts or cold snaps. Among birds, for instance, cranes are starting to spend the winter in Germany rather than fly south to Spain or Portugal. Whales are sometimes in the wrong place to feed on fish and plankton which were thriving closer to the

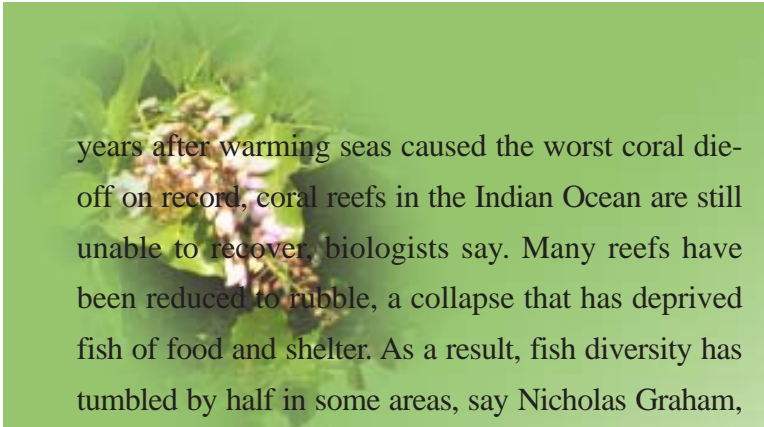
poles because of warmer oceans. For more information log on to <http://www.planetark.com/dailynewsstory.cfm/newsid/41760/story.htm>; www.eucc.net/en/news

Young fish return to "home reefs" to settle down

After spending weeks adrift in the ocean as tiny larvae, juvenile coral reef fish often return to their "home reef" to settle down, researchers say. The strong homing behavior shown by reef-dwelling butterflyfish in the waters near Papua New Guinea came as a surprise to scientists, and it may have important implications for the design of marine reserves. Researchers and fisheries managers have long sought better information on how very young fish disperse in the ocean. Tracking the fate of tiny larvae has been extremely difficult, since the fish are too small for even the smallest electronic tags. So a team led by Glenn Almany of Australia's James Cook University used a new method for chemically "tagging" fish while still in the egg stage inside their mothers' bodies. Later recovery of the tagged juveniles showed that as the fish matured, they returned to their place of birth. On a very small reef, the team found, more than 60 percent of the recently settled young were offspring of adult fish living in the same location. For more information log on http://news.nationalgeographic.com/news/2007/05/070504-reef-fish_2.html

Global warming has devastating effect on coral reefs, study shows

In 1998 an El Niño weather pattern sparked the worst coral-bleaching event ever observed. Eight



years after warming seas caused the worst coral die-off on record, coral reefs in the Indian Ocean are still unable to recover, biologists say. Many reefs have been reduced to rubble, a collapse that has deprived fish of food and shelter. As a result, fish diversity has tumbled by half in some areas, say Nicholas Graham, a tropical marine biologist at University of Newcastle Upon Tyne in U.K. Surveying 60,000 square yards (50,000 square meters) of coral reef across 21 sites, researchers found that fish diversity declined on most reefs that had sustained physical and biological erosion. The finding by U.K., Australian, and Seychelles researchers confirms what many scientists had long suspected. The census also revealed that four fish species - butterfly fish, damselfish, and two wrasses - may now be locally extinct. Six other fish species have declined to critically low numbers. For more information log on <http://news.nationalgeographic.com/news/2006/05/warming-coral.html>

Oldest lobster fossil found in Mexico

This fossil crustacean found out in Mexico's Chiapas State in 1995 has now been confirmed as the world's oldest lobster, according to scientists at the National Autonomous University of Mexico (UNAM). The ancient animal has been dated 110 million years old - about 20 million years older than previously known specimens - UNAM scientists announced in a press release. This lobster belongs to the genus that is in Africa today, UNAM geologist Francisco Javier Vega Vera told the Reuters that "This is not surprising because at that time Africa and America were relatively close". The two continents are believed to have started drifting about 120 million

years ago. The juvenile fossil lobster, dubbed *Palinurus palaceosi*, was among the remains of several ancient fish and crustaceans found in a quarry in the tiny town of El Espinal. Vera says the region could be where the evolution of modern lobsters began. For more information log on <http://news.nationalgeographic.com/news/2007/05/070503-oldest-lobster.html>

Tsunami swamped England 400 years ago, study says

A tsunami struck coastal England 400 years ago, causing the deadliest natural disaster in the history of the United Kingdom, a study suggests. The massive wave was responsible for the flood on January 30, 1607, that swamped the Bristol Channel in southwestern England, submerging more than 190 square miles (500 square kilometers) of land and killing some 2,000 people, the study points out. The 1607 disaster had previously been attributed to a freak storm surge, but the authors of the new study say geological clues in the area are telltale signs of a tsunami. For more information log on <http://news.nationalgeographic.com/news/2007/05/070507-tsunami-britain.html>

Global warming could shorten day, report predicts

Earth's familiar 24 hour day may become about 12 hundred-thousands of a second shorter due to the long-term trend of global warming, a new report contends. Alongwith various environmental consequences, the scientists have pointed out redistribution of Earth's water due to global warming arising out of emission of heat-trapping gases. This

would occur because of changes in water temperatures. Felix W. Landerer of the Max Planck Institute for Meteorology in Hamburg, Germany, and his colleagues calculated the effects of this redistribution on the Earth's spin which in turn determines the length of the day. If an appreciable amount of the weight of ocean waters redistributes itself toward the poles, this reduces the extent to which the planet as a whole bulges at the equator. This then results in something similar to what happens when a spinning skater pulls her arms in towards herself, the spin speeds up.

Earth may witness an analogous effect. The effect occurs because a rise in ocean temperatures would raise sea levels, the scientists explained. A considerable amount of ocean mass may transfer away from deep waters to shallower continental shelves, the sea-beds that surround continents. For more information log on http://www.world-science.net/othernews/070507_warming-day.htm

“Whopper” giant squid washed ashore in Australia

One of the largest giant squids ever found was washed ashore on a beach in southern Australia on 10 July, 2007, providing greater insights about the animal's habits and habitat, scientists said. The squid was discovered on a beach late at night on the western coast of Tasmania.

Biologists who inspected the squid said it weighed 550 pounds (250 kilograms) and stretched 26 feet (8 meters). The beast might have been even longer when it was alive as the tentacles appeared to

be badly damaged. It was identified as a whopper by Genefor Walker-Smith, curator at the Tasmanian Museum.

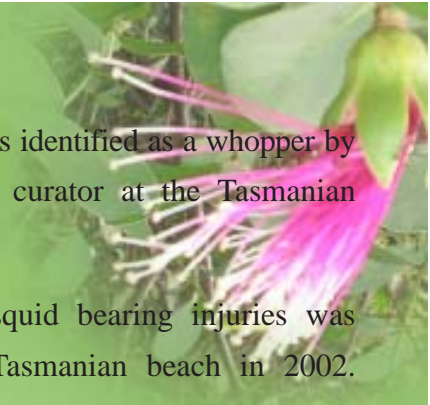
Another giant squid bearing injuries was washed ashore on a Tasmanian beach in 2002. Scientists at that time suspected that the wounds were the result of a raucous sexual encounter, suggesting that giant squid may breed nearby. There was no word on the cause of death of the newfound squid, but scientists have collected tissue samples to conduct DNA and other tests. The results could shed new light on an animal that is rarely seen outside the darkness of the deep.

A live giant squid was photographed for the first time in 2004, and another was captured and filmed a year later, both off the coast of Japan. For more information log on <http://news.nationalgeographic.com/news/2007/07/070711-squidpicture.html?email=Inside20July07>

Warmer oceans fuel coral disease

Coral reefs around the world have been declining during the past few decades, and scientists have implicated global warming as one of the main causes. But apart from small-scale, local studies data supporting this hypothesis have been lacking. Now, a new study, published online (May 8, 2007) in *PLoS Biology*, demonstrates for the first time a clear link between higher ocean temperatures and a coral disease called white syndrome.

Warmer oceans combined with dense coral colonies are likely to help the spread of infectious coral diseases, leading to mortality. Courtesy : Science News, May 23, 2007.





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