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INSTRUCTIONS TO AUTHORS

Seshaiyana welcomes original articles, snippets and cartoons in the area of coastal wetlands, preferably, estuaries, mangroves, coral reefs and lagoons. The newsletter accepts popular/research articles, reviews, news and notes. Details of forthcoming seminars/symposia/trainings/workshops will also be considered for publication.

The articles should not exceed five typed pages in double space.

Line drawings and cartoons should be clear for good reproduction.

References should be limited and cited in the text by name and year. Council of Biological Editors' style manual may be referred to for listing references at the end.

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Front cover photo : Sea anemone with clown fish

Seshaiyana

ENVIS Newsletter on Estuaries, Mangroves, Coral Reefs and Lagoons

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Hello Readers,

Over the years, this newsletter has come in different dimensions covering various facets of the coastal and marine ecosystems, thereby playing an important role in the dissemination of information to the scientific community world over.

This volume carries variety of information on coastal and marine ecosystems. The first article on marine microbenthos describes clearly about their distribution, role in mineralisation, food web and productivity of the marine ecosystem. Following this is an article which throws light on the antifungal activity of 128 bacteria isolated from the rhizosphere soils of six mangrove trees in the Bhitarkanika mangrove ecosystem. Out of the 128 bacterial isolates tested, only 43 showed antifungal activity. The third article documents the association of fungi with different mangrove species of the Bhitarkanika ecosystem. The fourth article elaborates the impact of encroachment in Achara estuarine mangrove ecosystem of Maharashtra. Due to encroachment, the mangrove has lost 56 ha out of its total area of 210 ha. There is also no regular inundation. Therefore the rare mangrove species here are fast disappearing. The next article explains the distribution of cone snails in the Gulf of Mannar Marine Biosphere Reserve. Out of the 20 cone snails found to occur here 5 species are reported to be dangerous to Man. This article also provides some tips for treating cone stings and prevention. The sixth article highlights the workshop conducted in Kerala on Forestry for Disaster Management in the aftermath of tsunami. The last article explains well the various strategies evolved by the Kerala Forest Department for coastal aforestation in collaboration with other agencies.

This issue also includes abstracts of recent publications on estuaries and mangroves apart from information on forth coming research meets.

Prof. T. BALASUBRAMANIAN
Prof. S. AJMAL KHAN

Inside this issue....

ROLE OF MARINE MICROBENTHOS IN PRODUCTIVITY

The term 'Benthos' refers to flora and fauna living in and on the substratum in an aquatic environment. The distribution of benthos in the marine environment extends from the intertidal zone to the abyssal depth. Depending on the ecological niche inhabited, they are classified as interstitial, eulittoral, sublittoral and abyssal benthic communities. Their distribution is inversely proportional to depth and thus littoral zone supports rich benthic communities than deeper waters. Benthos is classified on the basis of their size and their position in the sediment. The organisms that live within the sediment are called as 'infauna' and those which are either attached or move at or on the surface sediment are called as 'epifauna'. Based on the size, benthic organisms are classified into three categories namely macrobenthos which are greater than 0.5 mm in size; meiobenthos which are less than 0.5 mm but more than 0.062 mm (62µm) and microbenthos which are less than 0.062 mm. Microbenthos are mainly composed of bacteria, ciliates, micro-flagellates, fungi and virus. Among these bacteria are the most numerous and ubiquitous.

In the sediment, bacteria and fungi constitute a major part of the food for the fauna where bacteria alone account for more than 50% of the metabolism of the benthic communities and meet 1-10% of the nitrogen requirements of invertebrates living in the sediment. In the deep sea, also bacteria form the main food for the benthic organisms. They have the ability to breakdown virtually all natural organic compounds into the components from which they originated. Microbial decomposition involves oxidation process which leads always to considerable oxygen consumption. Under favorable conditions this may result in the complete disappearance of oxygen. Decomposition of protein takes place by proteolytic bacteria eg. *Pseudomonas* and other eubacteria. Cellulose is decomposed by cellulolytic bacteria eg. *Cytophaga, Sporocytophaga*. Chitin is degraded by *Pseudomonas* and *Vibrio* by chitinase enzyme. Apart from these, bacteria have greater role in mineral cycles. For example, iron cycle is mediated by some bacteria which can oxidize ferrous to ferric compounds: $Fe^{2+} \rightarrow Fe^{3+}$ + 1.5 Kcal. eg. *Leptothrix, Crenothri*; manganese cycle is mediated by some of the bacteria which utilize manganese and manganous compounds and oxidize these to manganic compounds eg. *Gallionella*; in phosphorous cycle organic phosphorous compounds are broken down to release phosphate from them by *Aeromonas, Bacillus, Pseudomonas* etc. and thus all the mineral cycles take place due to different groups of bacteria (Rheinheimer, 1980). That way heterotrophic bacterial action promotes organic degradation, decomposition and mineralization processes in sediments and in the overlying water releasing dissolved organic and inorganic substances. Therefore, the heterotrophic microorganisms are the major agents shaping the organic composition of the ocean.

Different microbes are capable of either taking up or releasing (regenerating) inorganic nutrients in aquatic ecosystems, but heterotrophic bacteria are uniquely involved in both the processes. They breakdown organic substances to products like ammonia, carbon dioxide, phosphate and silicate. They themselves act as nutrient sources (Adair and Gunderson, 1969). These heterotrophic bacteria comprise the bulk of microbial populations inhabiting the water column of oceans and are responsible for much of the biological transformation of organic matter and the production of carbon dioxide in the oceans (Sherr and Sherr, 1996). Distribution of bacteria depends on changes in water temperature, salinity and other physico-chemical parameters (Alavandi, 1990).

Bacteria not only maintain the pristine nature of the environment but also serve as biological mediators through their involvement in the biogeochemical processes. The abundance and distribution of total heterotrophic bacteria have a direct bearing on other forms of nutrients in different compartments of the environment. The microbial population of any environment changes and fluctuates in response to the source water and sediment in which they are found, as well as to the composition of various materials found in the environment.

Several ciliates especially intestinal forms living in an environment rich in organic materials, are devoid of a mouth and hence are sporozoans. The ciliates can according to their food be classified as bacteriophages, herbivores

and carnivores or histophages. Cilliates feed on *Thiobacillus* and other chemoautotrophs (Fenchel, 1968). Several ciliate groups specialize on sulphur bacteria and seem to be dependent on their presence. For example, species like *Cristigera media* feeds on these sulphur bacteria. Thus, as one of the main consumers of bacteria, they can enhance the bacterial production and therefore the degradation of organic material. It has also been found that the low abundance of protozoan ciliates, results in no amoeba and only very few species of flagellates (Hausmann *et al.,* 2002). The ciliated protozoan also plays an important role in the organic matter fluxes in both pelagic and benthic environments (Azam *et al*., 1983).

The flagellates present in the marine environment are composed of several taxonomic groups such as euglenids, kinetoplastids, heterokonts, cryptomonads and dinoflagellates. Through their ability to graze bacteria, heterotrophic flagellates play an important role in the remineralization of organic carbon. Through the action of the flagellates and bacteria, much of the utilizable organic matter including the particulate organic pool, is remineralized within the upper mixed layer of the oceans (Taylor *et al.,* 1985).

Viruses have high abundances both in the waters and sediments, ranging from 10^6 to 10^8 ml^{-1} (Fuhrman, 1999). Viriobenthos (benthic virus) abundance in sediment mirrors bacterial abundance and production by infecting 10-32% of bacteria per day. These infected bacteria in turn may be consumed by metazoan fauna and then excreted as faeces which settle on sediments. Moreover, the viriobenthos have important effect on biogeochemistry and productivity of overlying waters by supporting greater autochthonous production. They have profound effects on microbial loop dynamics and biogeochemical cycling of organic matter. By lysing bacteria and phytoplankton, viruses may divert carbon away from larger bacteriovores and herbivores and consequently return carbon, which would otherwise be utilized at higher trophic levels. In addition, viruses in the ocean also play a key role in the production of dimethyl sulphide (DMS) gas. Thus, bacteria, ciliates, amoeba, heterotrophic flagellates and viruses altogether form a complex part of the microbial food web thereby influencing the benthic productivity of an aquatic ecosystem.

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ANTIFUNGAL ACTIVITY OF BACTERIA ASSOCIATED WITH MANGROVE TREES

Mangrove vegetation plays an important role in contributing organic matter to its associate biota by virtue of microbial activities on litter decomposition (Kohlmeyer *et al*., 1995). Very few studies have been done on the antimicrobial activity of mangroves (Christophersen *et al*., 1998; Bhosle *et al*., 1999). Therefore, in this investigation, effort was taken to isolate bacteria from rhizosphere soil of some mangrove trees in Bhitarkanika for the purpose of evaluating their antifungal properties against pathogens causing black mold disease.

Rhizosphere soils of six mangrove trees (*Avicennia officinalis, Excoecaria agallocha, Heritiera fomes, Kandelia candel, Phoenix paludosa* and *Tamarix troupii*) were collected from Bhitarkanika mangrove ecosystem of Orissa. Bacteria were isolated by serial dilution and characterized through enzymatic and extracellular activities. Co-plating method was followed for the inoculation of test bacterial isolate and rose pathogen. Finally, observations were made on the inhibition zone around the fungal colony (mm).

Over all, 128 bacteria were isolated from 6 different soil samples. As many as, 97 rods and 30 cocci shaped bacteria were found. Among them 81 belonged to gram positive and 45 to gram negative bacteria. All bacteria were tested for their antimicrobial properties against plant pathogen BM (137) and positive bacterial isolates were characterized for their morphological and biochemical properties. The results obtained from the present study are shown in Figs. 1-6.

In *Tamarix troupii*, totally 12 bacteria were isolated and only two isolates showed zones of inhibition of 2 and 4 mm around the colony (Fig. 1). Both were rods, protease catalase, VP (Voges Proskawer) positive and fermentative.

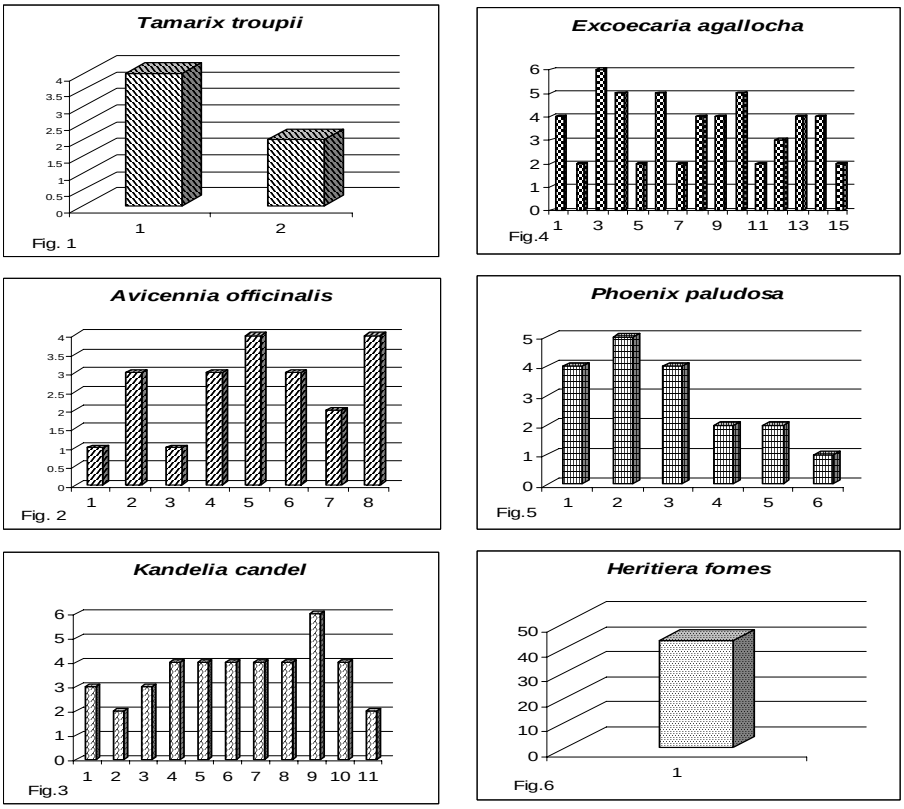
In *Avicennia officinalis*, 30 different bacteria were isolated and tested for their antifungal properties. Among them 8 isolates showed inhibition zones of 1-4 mm (Fig. 2). All bacteria were citrate utilisers and fermentative for dextrose, sucrose and lactose. Variation was found among them for their extracellular enzyme activity and acid producing properties. However, all were H_2S negative.

Totally 11 bacteria were isolated from soil of *Kandelia candel* and all were found to be active against pathogens. They formed zones of inhibition of 2-6 mm around the bacterial colony (Fig. 3). All isolates were VP positive except two, dextrose and sucrose positive and H_2S negative. Most of them were amylase positive.

Over all 57 bacteria were isolated from soil of *Excoecaria agallocha* out of which 16 isolates were endowed with antifungal properties as they formed inhibition zones of 2-6 mm around the pathogen colony. All were VP positive, H_2S negative and fermentative rods. The performance of the extracellular enzyme produced varied (Fig.4).

In soil of *Phoenix paludosa*, 14 bacteria were isolated and 5 were found to be positive for their antifungal properties against rose pathogen. They formed inhibition zones of 1-5 mm. All bacterial isolates were VP positive, H_2S negative and fermentative for dextrose and sucrose (Fig. 5). Among the 4 bacteria isolated from the rhizosphere soil of *Heritiera fomes* only 1 was found with antifungal activity against BM (137). The zone of inhibition around its colony was 5 mm (Fig. 6).

Production of various metabolites and their antifungal activity against pathogenic fungi have been reported by several workers (Mathivanan and Murugesan, 1999; Someya *et al*., 2003). In the present study, the antifungal activity of all positive bacterial isolates varied. It is noteworthy that a large number of bacterial strains have got the ability to act against pathogens BM (137). It assumes significance as these bacterial isolates have been obtained from mangrove area, from where not much is known regarding antimicrobial activity (Corte *et al*., 2000). The present study is very important as selection of potent antagonist for biological control of plant disease usually involves collecting and screening large numbers of microbial isolates to enhance the probability of discovering highly effective strains. The outcome of present study is quite significant in that as many as 43 bacterial isolates were found to be positive against the given plant pathogens.



Figs. 1-6. Antimicrobial activity of bacteria isolated from different mangrove species
X axis - bacterial isolates; Y axis - inhibition zone in mm

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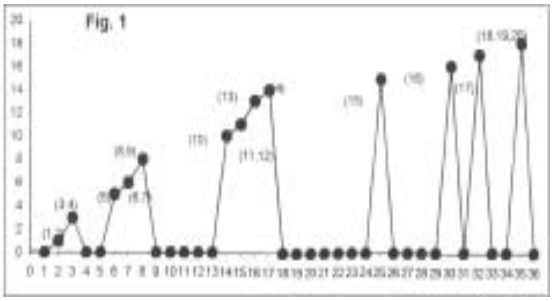
FUNGI ASSOCIATED WITH DIFFERENT PLANTS OF BHITARKANIKA MANGROVES IN ORISSA

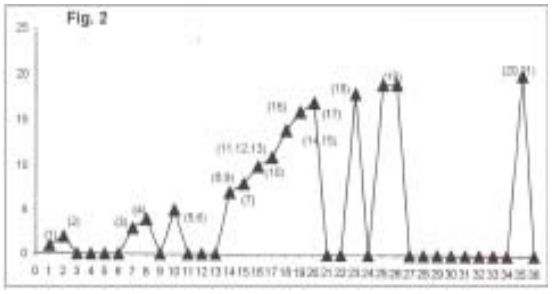
Mangrove ecosystem is highly productive and biologically diversified. It indirectly supports other biological systems by supplying them with organic matter which provides an ideal substance for wood destroying fungi, bacteria and animals. Compared to the terrestrial microbes, information regarding the microbes from the marine environment is less. Therefore there is a need to isolate and record the biological activities of microorganisms. Bhitarkanika is one of the largest mangrove forests in India which has not been studied well as far as the microbes are concerned. In the present study, the occurrence of different fungi in the rhizosphere of mangrove plants in Bhitarkanika mangrove ecosystem has been documented.

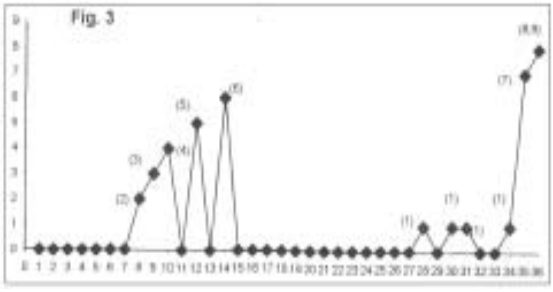
The fungi from the rhizosphere soil samples of different mangrove plants were isolated on basal PDA (Potato Dextrose Agar) medium having *p*H of 5.5 using serial dilution method. All pure cultures of fungi were identified morphologically.

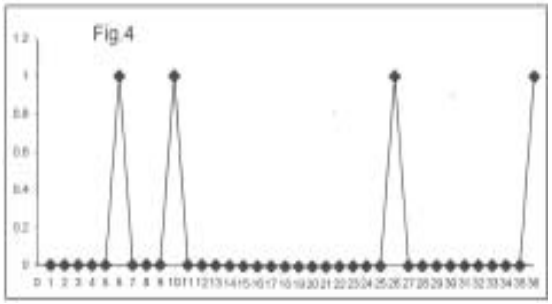
The distributional pattern of the fungi associated with different mangrove plants is presented in Figs. 1-10. The code number for different plants studied is given in Table 1. Results showed the occurrence of *Penicillium* in 21 species followed by *Aspergillus* in as many as 20 species and *Fusarium* in 9 species. *Curvularia* sp., *Diploidea* sp., *Stachybotrys* sp., *Pestalotiopsis* sp., *Besipetsproa* sp., *Chalariopsis* sp., *Hersonila* sp., *Mucor* sp., *Rhycosporium* sp., *Schophulariopsis* sp., *Piptocephalis* sp. were present in varying numbers of mangrove species.

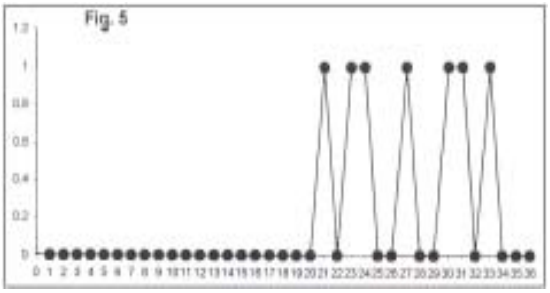
Several reports are available on the fungi in the mangrove region (Patil and Borse, 1985; Maria and Sridhar, 2002; Ananda and Sridhar,

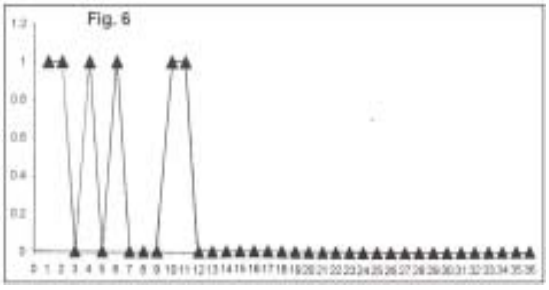


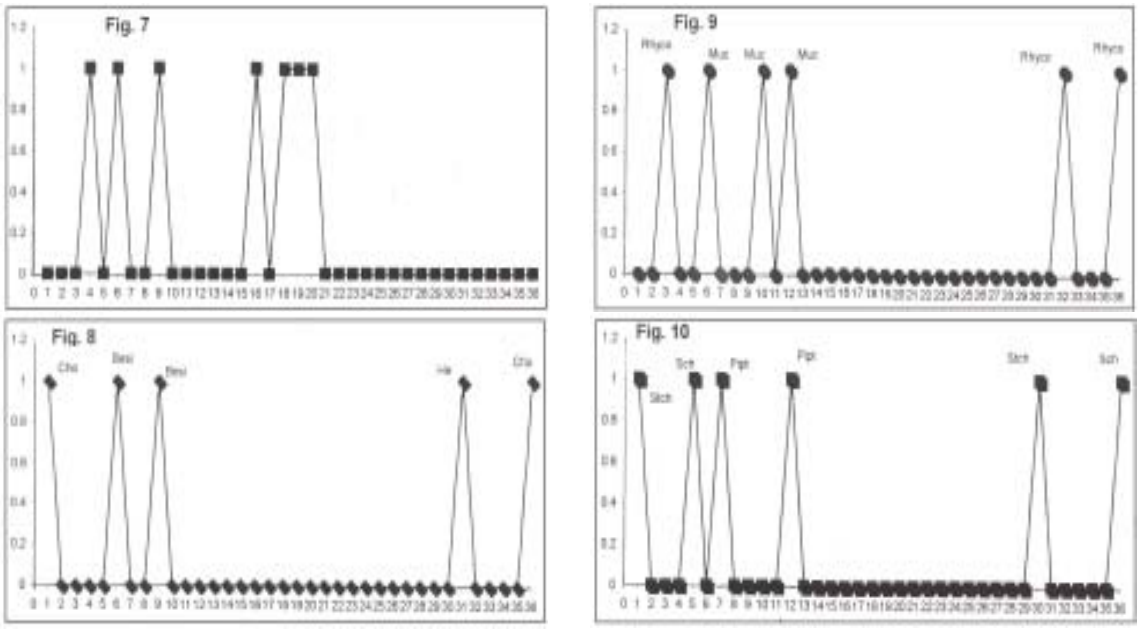












Figs. 1-10. Occurrence of fungi in different plants of Bhitarkanika mangroves in Orissa
Fig.1. *Aspergillus* sp., Fig.2. *Penicillium* sp., Fig.3. *Fusarium* sp., Fig. 4. *Curvularia* sp., Fig. 5.*Diploidea* sp., Fig. 6. *Stachybotrys* sp., Fig. 7. *Pestalotiopsis* sp., Fig. 8. *Besipetspora* sp., *Chalariopsis* sp., *Hersonila* sp., Fig. 9. *Mucor* sp., *Rhycosporium* sp., Fig. 10. *Schophulariopsis* sp., *Piptocephalis* sp.

2004; Schmit and Shearer, 2004). As information on the occurrence of fungi from Bhitarkanika mangroves is not available, this study provides baseline information about association of fungi with mangrove plant species. Differences in the occurrence of fungi in various rhizosphere may also provide information regarding the preference of the microbes for the mangrove species.

Table 1. Code number of different plants studied

1	*Avicennia marina*	19	*Lumnitzera racemosa*
2	*Suaeda maritima*	20	*Xylocarpus granatum*
3	*Heritiera fomes*	21	*Cynometra iripa*
4	*Excoecaria agallocha*	22	*Derris trifoliata*
5	*Avicennia alba*	23	*Sonneratia caseolaris*
6	*Kandelia candel*	24	*Suaeda nudiflora*
7	*Caesalpinia crista*	25	*Stictocardis cordifolia*
8	*Phoenix paludosa*	26	*Cyperus corpus*
9	*Bruguiera parviflora*	27	*Sonneratia* sp.
10	*Aegiceras corniculatum*	28	*Salacia chinensis*
11	*Ceriops decandra*	29	*Kalanchoe pinnata*
12	*Aegialitis rotundifolia*	30	*Derris heterophyla*
13	*Pongamia pinnata*	31	*Caesalpinia bonduc*
14	*Aglaia cuculata*	32	*Salicornia* sp.
15	*Tamarix troupii*	33	*Avicennia officinalis*
16	*Heritiera littoralis*	34	*Lucas stricta*
17	*Sonneratia apetala*	35	*Cyperus axanius*
18	*Xylocarpus mekongenesis*	36	*Hibiscus tiliaceus*

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ENCROACHMENT IN ACHARA MANGROVE OF MAHARASHTRA – A CASE STUDY

Globally the mangroves are under tremendous human pressure. Due to this biodiversity in mangroves is rapidly decreasing. Recently, Kathiresan and Rajendran (2003) reviewed the threats to mangroves.

Some of the estuaries in Maharashtra have been well studied with respect to human interference and pollution (Bhosale, 1990a,b). However ecology of encroached mangrove land has not been studied. In Maharashtra, encroachment of the estuarine region by putting up bunds is in practice since the last two decades (Bhosale and Mulik, 1991). Erection of bunds restricts the incoming tidal water in the mangrove land, which is actually the key feature of this ecosystem. The encroached region neither supports agriculture nor the mangroves properly. Borderline mangrove plants and rare mangrove plants such as *Xylocarpus granatum, Cynometra iripa, Bruguiera gymnorrhiza, Kandelia candel, Sonneratia apetala* are disappearing fast. Therefore ecorestoration programs should be undertaken in such lands. An attempt was made to collect data on 'Ecology of encroached mangrove land' in Achara estuary of Maharashtra.

Total area under Achara mangrove is 210 ha of which 56 ha have been encroached. Most of the encroached areas lack daily inundation and receive salt water only through leakage from bund. It increases the soil salinity (chloride and sulphate salinity) beyond tolerable limits. The encroached areas are sandwiched between mangroves and the habitations of local people as well as crop fields. Thus, they become a conduit for land runoff adding many pollutants, salts, nutrients especially nitrogen, trace elements and heavy metals. However low levels of total soil phosphorus were detected in encroached lands. C : N and C : P ratios indicated abundant nitrogen but phosphorus deficiency. Soil *p*H mostly remained on the alkaline side.

Surface structures of these areas are disturbed due to activities like soil mining and bund repair. Soil slowly becomes hard and compact loosing shifting natures.

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HUNDREDS OF NEW OCEAN SPECIES DISCOVERED IN 2004

Marine scientists say they have discovered more than one hundred new species of fish and more than hundred new species of plants and other animals in the year 2004 raising the number of life forms found in the world's oceans to about 230,000. Leaders of the Census of Marine Life (CoML), now four years into a planned 10-year count, say the rate of discovery shows no sign of slowing, even in European and other heavily studied waters. They expect the oceans to hold 20,000 species of fish and up to 1.98 million species of animals and plants, many of them small, basic life forms like worms and jellyfish. For a detailed press release by CoML, visit http://www.coml.org/medres/medres1.htm

KILLER SNAILS OF THE GULF OF MANNAR MARINE BIOSPHERE RESERVE

The predatory cone snails are among the most successful marine animals. The genus *Conus* consists of a large number of species, belonging to the family Conidae and class Gastropoda. More than 500 species are found distributed throughout the tropical Pacific and Indian oceans (Kohn, 1963). In view of the rich diversity in the marine realm, there are innumerable predators and it has become necessary for these gastropods to develop an effective defense mechanism. The cone snails have developed such a mechanism with a potent venom (neurotoxin) to protect them from predators and to paralyze their prey (Olivera *et al.*, 1985). The cone snails inject a highly poisonous paralyzing toxin by means of a harpoon-like mechanism. Few of the larger species can fatally sting Man. There have been 30 recorded cases of human envenomation by *Conus* species, some of which were fatal (Kohn, 1958). The venom possesses a diverse mixture of pharmacological agents that make them valuable tools in biomedical research.

The Gulf of Mannar is one of the Marine Biosphere Reserves in India, situated on southeast coast, with 21 islands extending from Rameswaram to Tuticorin. It is highly productive and biologically very rich. Twenty shallow water species of cone snails occur here inhabiting the coral reef platforms along the coast and in the offshore region. Among them only the following four species are known to be more dangerous to man:

Geographic Cone, *Conus geographus* Linne. Shell large, light and low-spire with coronated whorls, body whorl dark brown with irregular white blotches, often with two broken spiral bands, and aperture bluish white.

Marbled Cone, *C. marmoreus* Linne. Body whorl and spire dark brown, marked throughout with rounded triangular white spots, the apices directed towards the outer lip, outer portion of aperture white, often pale pink within.

Striated Cone, *C. striatus* Linne. Shell large, body whorl pinkish white, irregularly clouded with purplish brown blotches composed of very closely spaced transverse lines, spire white, tessellated with lighter brown, roundly collabral markings, aperture white.

Textile Cone, *C. textile* Linne. Shell light, strong with smooth surface, body whorl white with undulating axial brown lines interrupted by white triangles arranged as scale, spire straight with gently concave and similarly marked, aperture white.

First aid for cone snail stings: The venom of these creatures contains a number of neurotoxic peptides that cause weakness and loss of coordination. The victims have the symptom of loss of vision, numbness, local pain, swelling etc. Severe envenomation causes respiratory muscle paralysis which may lead to death (Kohn, 1958). No antivenom has been developed for cone snail stings. Pressure-immobilization can be used and, if necessary with ventilation. As the wound can be contaminated, tetanus prophylaxis should be performed.

Prevention: Prevention is probably the most important aspect. Live cone shell should be handled with care, and effort should be made to avoid contact with the soft parts of the animal. Live cone snails should not be placed in pockets. They are capable of inflicting stings through the cloth. If handling is necessary thick heavy gloves should be worn and the shell should be held by the blunt posterior end.

Cone snail biology: The cone snails are sheltered in the shallow waters of the coral reefs and sandy or coral rubble substrates (Kohn, 1978) and usually found between 9 and 18 m depths and at a distance of 5-8 km from the shore. They detect prey in their environment using a "siphon" which bristles with

chemoreceptor. They then extend their proboscis out towards the unfortunate target. These snails hunt for their prey mainly at night with their elongated proboscis (a mouth part) containing tiny harpoon-like structures which are modified teeth. On coming in contact with the prey, one harpoon is shot in to the prey followed by the pumping of venom to paralyze it within a short time. The potency of the venom varies according to the species but generally, those that feed on fish have very lethal toxin even to man (Kohn, 1958). Based on their food preference, they are classified as piscivorous, molluscivorous and vermivorous.

Venom apparatus of cone snails: The venom apparatus consists of radular sac, cucumber-shaped venom bulb and a long, coiled tubular venom duct. The venom duct secretes the venom, which is a milky substance and the venom bulb pumps the venom into the radular tooth, and injects into the victim. The pharynx and proboscis, which are part of the digestive system, also play an important role as accessory organs.

Cone snail venom: The venom consists of small peptides that are targeted to various neuromuscular receptors, and may be equivalent in their pharmacological diversity as that of alkaloids from plants or secondary metabolites of microorganisms (Olivera *et al*., 1995). With a large number of different peptide components, the venom exhibits a wide range of biological activities. The active components of the venom are small peptide toxins, typically 12 - 30 amino acid residues in length and are highly constrained peptides due to their high density of disulfide bonds (McIntosh *et al*., 1999). The complement of peptides found in any one of the *Conus* venom is strikingly different from that found in the venom of another *Conus* species and thus, in the whole genus, many tens-of-thousands of distinct pharmacologically active peptides have been evolved (Olivera *et al*., 1990).

The paralytic component of the venom that has been the focus of many investigations includes the α, ω and μ-conopeptides. All these peptides act by preventing neuronal communication, but each targets a different aspect of the process to achieve this. The α-conopeptides target nicotinic ligand gated ion channels, the μ-conopeptides target the voltage gated sodium channels and the ω-conopeptides target the voltage gated calcium channels. The α-conopeptides, which are highly selective for nACh receptors that discriminate between closely related subtypes have many potential applications in anxiety, Parkinson's disease, pain, as muscle relaxants and as antihypertensive agent (McIntosh *et al.,* 1994). The μ-conopeptides, which target neuromuscular sodium channel, have the potential to treat neuromuscular disorders (Cruz *et al*., 1985). The ω-conopeptide MVIIA has a selection for the N-type calcium channel (Olivera *et al.,* 1994) and this channel is involved in neurotransmitter release and is a crucial component of the neural pathways that mediates pain, and it is currently undergoing clinical development for the treatment of chronic pain by Neurex. The μO-conopeptides inhibit neuronal sodium channels (Cruz *et al.,* 1985), while κ-conopeptides interact with potassium channel (Shon *et al*., 1998) and might have a wide therapeutic potential. Other families of conopeptides target G-protein coupled receptors, such as the conopressins that are active at vasopressin receptors (Cruz *et al.,* 1987). The contulakin-G, a conopeptide with c-terminal homology to neurotensin was isolated from *C. geographus*. In animal models, this peptide was shown to be a potent analgesic compound and now it is a lead compound for commercial analgesia programme (Olivera and Cruz, 2001). It has also entered pre-clinical trials for short-term management of post-operative pain (Jones and Bulaj, 2000). The conantokin-G is a sleeper / climber peptide isolated from piscivorous cone snails, which interacts with N-methyl D-asparate (NMDA) receptors (Mena *et al*., 1990) and this peptide is being considered as a potential therapy for CNS disorders (Shen *et al*., 2000).

Great design by nature: In fact, some believe they are hyper variable, denoting that there may be a special genetic mechanism used by the cone snails to create increased variability of these inter-cysteine residues. Further study needs to be done to elucidate the mechanism for this observed hyper variability. Within a structural category, the rigid cysteine backbone and conserved folding apparatus combined with a hyper variability of inter-cysteine residues result in the ability of cone snails to produce a overabundance of related peptides. This way, new toxins can be produced having new specificities without risking complete loss of biological activity (Woodward *et al*., 1990).

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WORKSHOP ON FORESTRY FOR DISASTER MANAGEMENT

Hon. Minister for Forest and Wildlife Shri. Thiruvanchoor Radhakrishnan inaugurating the workshop on Forestry for Disaster Management

In the backdrop of Tsunami which hit Kerala coast in the last week of December 2004 and deprived of so many lives and property, Social Forestry Wing of the Kerala Forest Department organized a one day workshop at Vanasree Auditorium, Thiruvananthapuram on 2nd March 2005. This workshop on 'Forestry for Disaster Management' was organized for discussing various ideas and options which will be useful for moulding projects for Mangrove Conservation in the Kerala State and there by giving a shelter belt to coastal people.

Social Forestry Wing of the Kerala Forest Department invited about fifty non-governmental organizations and individuals who have contributed remarkably to the conservation of nature especially Wetland Conservation. Few eminent scholars were also invited.

Besides the Hon'ble Minister for Forest and Wildlife Sri. Thiruvanchoor Radhakrishnan, Forest Secretary Dr. C.V. Ananda Bose, Principal Chief Conservator for Forests Sri. R.P. Sharma, Additional Principal Chief Conservator of Forests Sri. K. Balachandran Thampi, Sri. K.P. Ouseph, Social Forestry Chief Conservator of Forests, Forestry Chief Conservators from other wings, noted environmentalist Smt. Sugathakumari and pioneer Mangrove Conservationist Sri. Kallen Pokkudan attended the workshop.

The Hon'ble Minister for Forest and Wildlife who inaugurated the workshop said that mangrove and Casuarina plants can play an important role during natural calamities like Tsunami.

A book entitled 'Varunaparvam', a collection of press clippings on the effectiveness of mangroves in creating a coastal shelter belt, was also released at the workshop.

Scholars like Sri. K.P. Ouseph, IFS, Dr. M.P. Nayar, Sri. S. Chand Basha, Dr. V.R. Prakasam, Dr. C.N. Mohanan, Sri. A. Goapalakrishnan Nair, Sri. G. Placid, Sri. K. Swarupanandan and Sri. R.C. Pandalai, Sri. B. Joseph, Sri. K.V. Uthaman, Sri. K.K. Chandran, Dr. K.M. Khaleel, Sri. V.R. Panicker, Sri. O. Jayrajan, Sri. T.P. Padmanabhan and Dr. N. Ramanujan presented papers explaining the importance of mangrove conservation and its usefulness in preventing loss of life and property during natural disaster.

The various organizations which participated in the workshop expressed their willingness to take up voluntary work in mangrove cultivation in the public land.

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HARITHA THEERAM – AN AMBITIOUS PROJECT FOR COASTAL AFFORESTATION

In the light of the Tsunami which devasted Kerala coast and deprived of hundreds of lives and property worth lakhs of rupees, Social Forestry Wing of the Kerala Forest Department prepared a new project aimed at providing a green shelter belt to coastal people. This ambitious project was inaugurated by Hon. Minister for Forest and Irrigation at Amrithapuri situated in the Kollam district of Kerala state.

The project entitled "Afforestation of the coastal area of Alappadu Panchayath in Kollam district in collaboration with Matha Amrithanandamayi Madam" aims at giving vegetative shelter belt along the 18 km long coastal line of Alappadu which gives shelter to 32000 people who are downtrodden and have no other means to protect themselves.

About half a century ago Alappadu Panchayath was very rich in mangroves. Greedy nature of Man destroyed the mangroves in the area and exposed the area to natural disasters.

Realizing the geographical pecularity of Alappadu (located as a long and narrow strip of land between sea and Kayamkulam lake), Social Forestry Wing of the Kerala Forest Department, planted 15 years ago some saplings of Casuarina hoping that these saplings would grow up, and protect the area from natural disasters. Unfortunately the hope turned dupe as the local people did not take care of the new saplings which limited their survival percentage. Now there are only some patches of Casuarina.

In this context, the social forestry wing initiated a serious discussion. At the end of the discussion, it was resolved to involve massive public participation in the implementation of future projects. Otherwise it would all be in vain as lines drawn over water.

Matha Amrithanandamayi Madam located at Karunagappally in the Kollam district has strong support of people. They are innumerable devotees in the south especially in Kerala. The Madam was happy to extend its cooperation for this project. The Kerala Forest Department and the Madam jointly decided to act as two wings of the project.

The project has the following objectives:

(a) To enhance the tree cover in the area by developing shelter belts, planting trees in homesteads, afforestation of institutional and Government lands etc.

(b) To initiate a programme to protect and develop mangroves in the areas by appropriate methods and by awareness creation.

(c) To improve the living condition of the local people by enhancing the wood resources in the area and by ensuring protection of life and property from natural disasters and

(d) To develop a model for participatory approach in coastal afforestation and mangrove conservation.

For achieving the objectives of the project, broad strategies have been evolved. The following strategies have been designed by Kerala Forest Department for implementation during 2005 – 2010:

1. Creation of shelter belts of Casuarina along the 18 km coastline with an average of 15 rows at one meter spacing using basketted seedlings.
2. Planting Casuarina in homesteads especially along the boundary of individual holdings and other spaces preferred by local people.
3. Supplying saplings of fruit bearing economically valuable plants and other seedlings preferred by the local communities.
4. Planting trees in institutional compounds, especially in government and private educational institutions, public places, religious institutions etc.
5. Afforestation of government lands including lands under the control of LSGs with appropriate tree species.
6. Protection of existing mangroves in government and private lands with the participation of people.
7. Developing mangroves in suitable lands in the panchayath with the assistance of scientific institutions and experts.

8. Creating awareness among the local people by conducting study classes, training, visits to successful areas, engaging social intermediaries etc.
9. Providing assistance to marginalized communities, especially women to adopt small income generating projects preferably related to forestry and environment.
10. Building partnership with suitable institutions and individuals in providing assistance for the implementation of the programme and
11. Developing people's institutions to actively participate in implementing the project.

Each of the parties- Kerala Forest Department, the Madam and Theera Samrakshana Samithy has its own duties and obligations. The duties and obligations are clear and distinct. For proper execution of the duties an agreement has been prepared and signed. According to the agreement, the obligations of each of the parties are the following:

Obligations of Kerala Forest Department

1. Production and supply of seedlings for the project free of cost.
2. Providing technical assistance for the tree planting programme.
3. Conducting training, awareness creation, visit to successful areas etc.
4. Extension and publicity.
5. Providing incentives for best services, awards etc.
6. Monitoring and evaluation.

Obligations of Matha Amrithanandamayi Madam

1. Organizing the local people and forming people's committees.
2. Acting as a social intermediary for the project.
3. Providing infrastructural facilities available with the Madam for the implementation of the project.
4. Meeting expenses if any towards organizing meeting, mass campaigns etc.
5. Assisting the local people in planting, protecting and maintenance of the tree planted.
6. Arranging frequent meetings of various people's committees as per the time schedule already fixed for the purpose.
7. Assisting the Kerala Forest Department in conducting, monitoring and evaluation etc.

Obligations of People's Committees

1. Assessing the requirement of seedlings for the planting programme.
2. Planting, protecting and maintaining the planted seedlings as per the technical advice given by the Kerala Forest Department.
3. Holding regular meetings to evaluate the progress of implementation.
4. Assisting the Kerala Forest Department and Matha Amrithanandamayi Madam in successfully implementing the programme.

The agreement also envisages the method of profit sharing. The benefits accrued out of the tree planting programme will be shared between Theera Samrakshana Samithy and the land owner at the rate of 25% and 75% respectively.

There is an important difference between this project and past projects of Kerala Forest Department i.e. effective and systematic evaluation and fault rectifying system is included as an integral part of the programme. Kerala Forest Department has designed the following arrangements for the proper monitoring and evaluation of the project.

a) A forester will be exclusively deputed to oversee the planting operations and further maintenance. He will also hold meetings of the people's committees once in a week.
b) The Forest Range Officer will inspect the programme once in two weeks and attend the meeting of the people's committees once in a month.
c) The Assistant Conservator of Forests will inspect the progress of implementation once in a month.
d) The Conservator of Forests will review the programme once in three months.

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ABSTRACTS OF RECENT PUBLICATIONS

ESTUARINE BIOLOGY

Distribution of diatoms and dinoflagellates in tropical waters of Orissa and West Bengal with emphasis on neritic assemblages

Distribution and diversity of diatom and dinoflagellate assemblage were studied in the neritic waters of Orissa and West Bengal. Totally 96 samples from 54 stations along 12 transects were collected during 2001-02 from the coastal waters. On examination 90 diatoms, 19 dinoflagellates and 3 haptophyceae along with one blue green algal taxa were identified and quantified. Maximum population of diatoms was observed during March 2002. Diatoms dominated the assemblage reaching 8.6 x 10^4 cells l^{-1}. The pinnate diatom *Nitzschia*, was the most dominating genus with 14 species followed by *Chaetoceros, Rhizosolenia, Navicula* and *Coscinodiscus* with 7, 6, 5 and 4 taxa respectively. The highest population of phytoplankton was observed in the surface waters of the neritic segment. Along the vertical gradient, a decreasing trend in the planktonic population was observed towards the bottom. NO_2-N and NO_3-N availability in the water column is the prime limiting factor for species assemblages and dominance of phytoplankton. Rivers and estuaries seem to be the point sources of the nutrients contributing to the near shore waters which showed higher nutrient concentration. The trace elements like iron and manganese are found to be the secondary limiting factors towards the growth and dominance of phytoplankton as they exhibited a strong correlation with the phytoplankton biomass. Throughout the year, the level of nutrients like nitrite, nitrate, phosphate and silicate were in the ranges of 0.17-1.34 µ mol l^{-1}, 0.85-6.63 µ mol l^{-1} and 1.3-3.33 µ mol l^{-1} respectively. Concentration of iron and manganese varied from 5.0 to 61 µ mol l^{-1} and from 0.03 to 4.73 µg l^{-1} respectively.

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Seasonal and spatial distribution of cyanobacteria in Cochin Estuary and nearshore waters

A systematic survey on seasonal and spatial distributions of cyanobacteria in 10 stations of Cochin estuary and nearshore waters from Vaduthala to Kannamali was conducted from April 2002 to March 2003. Cyanobacteria from surface and bottom water samples were identified, enumerated and cultured. A total of 44 species from 17 genera belonging to four families of Cyanobacteria were recorded of which 18 were unicellular colonial forms, 25 nonheterocystous filamentous forms and one heterocystous filamentous form. The predominant species observed were *Synechocystis salina, Synechococcus elongatus, Gloeocapsa crepidinum, Oscillatoria foreaui, O. subtillissima, Phormidium valderianum* and *Phormidium tenue*. Total cell count was very high in mangrove station whereas it was very less in Kannamali, the coastal area. In general, Cyanobacterial counts were more in surface water. Pre-monsoon period was characterised by high level of Cyanobacteria whereas cell count was very low in monsoon season. Strictly segregating most of the species into saline and fresh water forms was difficult as most of them showed broad tolerance to different salinity and could survive through most of the seasons.

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Plankton and water quality studies on Muttukadu Estuary, northeast coast of Tamil Nadu, India

The coastal zone contains the most used and abused marine biodiversity resources. The management of biodiversity and particularly human activity, which affects biodiversity, is recognized as a global priority in environmental management. Muttukadu estuary, Tamil Nadu, India, which is a part of the Buckingham canal situated along the northeast coast of Tamil Nadu was studied from July 2002 to June 2003 in order to assess the planktonic diversity and water quality. A total of 75 phytoplankton species were recorded along with 37 zooplankton species. Bacillariophyceae with 58 species dominated the phytoplankton group followed by cyanophyceae with 9 species, and chlorophyceae was represented by 4 species. Tintinnids dominated the zooplankton group with 15 species followed by copepods with 12 species. Dissolved oxygen (DO) (range 0.85 ml/l - 4.8 ml/l) was a found to be the main factor governing the plankton of this estuary. Nutrient loading was more during November 2002, which is due to the freshwater input of the monsoonal rain. The water quality studies revealed the fact that *p*H, salinity, DO, and nutrient (Si, N and P) concentrations, directly affect the distribution of plankton species.

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Bioaccumulation and impact of heavy metals in *Penaeus monodon* and *Metapenaeus moyebi* inhabiting Ennore brackish water ecosystem

A great deal of the pollutants have been produced by the civilized human by virtue of his input into industries and consequently the output being the release of pollutants into the aquatic ecosystem. Scientific studies confirm that different pollutants have varied impacts on the aquatic biota and in particular fishery resources that form a food resource to human. Thus it becomes increasingly apparent that industrialization and other multifaceted activities of human have caused aquatic pollution. India is one of the largest fish producing nations in the world ranking ninth among other nations. Almost all the pollutants interfere with the metabolism of the aquatic fauna including fish fauna. Pollutants exhibit lethality that is diversified in various organ systems. Respiratory changes include clogging of the gills due to the modification of bronchial cells by histopathological changes, whereas damage to haemopoietic tissue can lead to modification of the respiratory pigments of the blood and can decrease the oxyphoretic capacity of the blood. Generally the pollutants percolate into the cellular level through the cell membrane and interact with cellular macromolecules to inhibit the essential cellular metabolism. Thus, measurement of sub lethal responses at the cellular level could provide an insight for an assessment of water quality and environmental impact of pollutants. The present study discloses not only the effluents which cause imbalance in the brackish water ecosystem and shrimp inhabitation but also throws light on the effect on human health through the aquatic food chain.

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Studies on the life span, reproduction, tissue biochemistry and diesel oil toxicity in the estuarine cladoceran *Diaphanosoma celebensis*

Diaphanosoma celebensis Stingelin is a typical estuarine cladocera, reported for the first time in India from the Mandovi estuary of Goa, India. The results of the study made on the laboratory reared specimens of this species on the life span, neonate production, tissue biochemistry and toxicity of diesel oil have been described in the paper. Variations were observed in the life span and rate of neonate production between individuals of the 1st and 2nd generations. Both were found to be relatively higher in the 2nd generation, although age at primiparity and the size of neonate did not show any variation. The tissue biochemical composition of the fed and starved cladocerans showed marked difference. The

protein content in the fed cladocerans was five times higher (18.5 µg/cladocera) while the carbohydrate content in the starved cladocerans was three times higher (4.4 µg/cladocera). The calorific content was 120 kcal/g in fed ones as against 57 kcal /g in starved ones. Mortality rate in diesel oil was found to be related with the concentration and exposure time. Mortality was 100% in 0.66 ppm concentration during the experimental period of 8 days. LC_{50} was calculated to be 0.26 ppm. However, neonate production did not show any particular trend or consistency with concentration of diesel oil.

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A study on the distribution of naturally occurring radionuclides in the ecosystem of Athangarai Estuary (Palk Strait)

This paper presents the distribution of Terrestrial Gamma Radiation, Primordial Radionuclides, Gross Alpha and ^{210}Po in the ecosystem of Athangarai estuary. Measurements of Terrestrial Gamma Radiation, Primordial Radionuclides, Gross Alpha were made in sediment sample. Water, sediment and selected biota were subjected to ^{210}Po determination. The Terrestrial Gamma radiation level in Athangarai estuary was 9.4 ± 3.0 µ R/h. The Primordial radionuclides levels in the estuarine sediment were ^{238}U (0.9 Bq /Kg), ^{232}Th (8.45 Bq/Kg), ^{40}K (289 Bq/Kg). The Gross Alpha level in Athangarai estuary was 6.4 $mBq.g^{-1}$. In water, dissolved concentration of ^{210}Po was found to be 1.2 mBq/l and in sediment (6.3 Bq/Kg). The ^{210}Po activity in the biota fell within the range of 12.3 - 345.8 Bq/Kg. The bivalve mollusc *Meretrix casta* of the estuary was identified to concentrate higher level of ^{210}Po in its soft tissues, suggesting that it could be used as sentinel organism for ^{210}Po in an estuarine system. The significance of the results are discussed.

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Factor analysis of recent benthic foraminifera from the Coleroon river estuary, Tamil Nadu

Foraminiferan distribution of the Coleroon river estuary, Tamil Nadu, India was studied by a Factor Analysis. For this study, 56 sediment and bottom water samples were collected from 14 stations, once in three months, representing four seasons. In order to study the relationship between foraminifera and present day environment, live forms alone were considered. 56 foraminiferan species belonging to 31 genera were identified of which 13 were arenaceous agglutinated, 11 were calcareous porcelaneous and the remaining 32 were calcareous perforate forms. In the present work, three assemblages alone were taken, since they explained more than 93% of the total variance. From factor analysis, it was inferred that there are two distinct assemblage zones during all the seasons. The first and dominant assemblage zone was highly loaded in station 5 and was influenced by greater depth, higher salinity values, associated with higher fines (> 30% silt and clay) and higher $CaCO_3$ content of the substrate. The second zone was predominant in station 1 and was influenced by the sandy substrate, lesser fines and lesser organic matter of the substrate

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Selectivity of subtidal benthic invertebrate communities for local microalgal production in an estuarine mangrove ecosystem during the post-monsoon period

Stable isotope analysis was used as a tool to assess the main carbon sources sustaining the benthic invertebrate communities in an estuarine mangrove ecosystem along the southeast coast of India during the post-monsoon season. In particular, we wanted to test whether the large amounts of terrestrial carbon brought in during the monsoon influence the benthic foodweb in this area, by comparing with earlier data on the pre-monsoon period. The $\delta^{13}C$ of the dissolved inorganic carbon (DIC) pool was spatially variable, with lower values in the mangrove creeks (-10.6 to -8.9 pm) compared to those in the adjacent bay region (-4.3 to -2.6pm). Fixation of the $\delta^{13}C$ -depleted DIC in the mangrove creeks should therefore result in a partial overlap in the $\delta^{13}C$ signature of mangrove-derived carbon and local phytoplankton. The lack of correlation between δ^{13} values of benthic invertebrates (which showed a large spatial gradient of 8pm) and those of sediments or suspended matter (both showing only small spatial gradient of <2.5) indicated that invertebrates were highly selective for locally produced algal food sources. These results were similar to those obtained during the pre-monsoon period in the same area, although in each region δ^{13} values were consistently more negative (by 1-3pm) during the post-monsoon period, consistent with the seasonality in δ^{13} DIC. By defining selectivity as the relative spatial gradient in consumer $\delta^{13}C$ compared to the $\delta^{13}C$ of bulk particulate organic carbon (POC) and $\delta^{13}C$ CDIC (as a proxy for the variations expected in local producers), and assuming that the selectivity was similar along the salinity gradient, we estimated that benthic invertebrates rely almost entirely on locally produced microalgal carbon sources. A critical evaluation of earlier studies showed that there is currently no unambiguous evidence for a trophic role of mangrove litter in sustaining subtidal benthic and pelagic invertebrate communities in adjacent aquatic systems.

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MANGROVE BIOLOGY

The fishery, trade and conservation of seahorses along the Indian coast

Seahorses are among the most unusual fishes in existence, and are intended primarily for medicine rather than food. An organised fishery and trade of seahorses existed in India along the Palk Bay and Gulf of Mannar coasts. At the Palk Bay coast, seahorses are targeted by divers along with sea cucumbers and chanks. In the Gulf of Mannar, which provides a less suitable habitat, most of the seahorses are landed as by-catch of shrimp trawling. Seahorses are also fished from Kerala as a by-catch of trawling, though there exists no organised fishery and trade. A total of six species of seahorses were identified from the Palk Bay coast whereas only two species were obtained from Kerala. Most seahorses from India were exported to Singapore, Hong Kong, Malaysia and UAE from Chennai, Tamil Nadu, India. The volume of dried seahorse trade from India was estimated to be 9.75 MT as derived from the catch data in 2001, which was much higher than the official MPEDA statistics of 4.34 MT exported from India during 2001-02, underlying the fact that a lion's share of the exports might be through non-conventional means and had gone undeclared. Seahorses are vulnerable to degradation of their preferred sea grass, mangrove and coral reef habitats, apart from fishing. A holistic approach, based on a detailed study of the population dynamics of seahorses that is integrated with coastal zone protection measures and the known strategies of fisheries management, is critically important to conserve the seahorses

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Conservation strategy for Andaman and Nicobar Islands ecosystem

The Andaman and Nicobar Islands are known for their forest, mangrove and marine ecosystems. Mangroves which occupy about 10% of the land area serve as a spawning and breeding ground for fish, prawns and lobsters. The marine ecosystem has a tremendous variety of species of phytoplankton, marine invertebrates, and vertebrates. The continental shelf along the Andaman Sea is narrow and slopes down to great depths. The seas around the islands contain a variety of organisms such as dolphins, dugongs, sea turtles, starfish, and many more marine organisms. The islands also have the most diverse and largest spatial cover of coral reefs. They are home to a wide variety of plants and animals. Large scale destruction of mangroves for fuel and development activities, deforestation along the coastal regions and its consequent soil erosion, sand mining, encroachments, tourism, excessive fishing with the usage of mechanized boasts, trawlers, increased use of pesticides for agriculture and extensive bleaching have affected the island ecosystem, particularly the marine species and coral reefs. These problems are mainly due to lack of enforcement and implementation of environmental laws such as Coastal Regulation Zone notification etc., besides lack of environmental awareness amongst the people. This paper aims to focus on the problems of the unique marine ecosystems in Andaman and Nicobar Islands. The modalities of implementation of the Coastal Regulation Zone provisions and other environmental laws for the protection of marine ecosystem and a joint strategy for environmental education and awareness are also explored. The paper also puts forth a conservation strategy for Andaman and Nicobar Island marine ecosystems calling forth a multi-pronged stakeholder approach involving the Government agencies, voluntary organizations and individuals.

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Economics of mud crab fattening in West Bengal

The mud crab, *Scylla serrata*, also known as mangrove crab is a portunid crab, that is, it is a member of a group of swimming crabs which has the last pair of legs flattened for swimming. *S. serrata* is the largest portunid crab. Mud crabs have a smooth and broad carapace. They have nine even sized teeth on each side of their eyes. In the most common form, the colour varies from very dark brown to mottled green. The other, generally smaller form has a deeper body and is reddish brown. In India the mud crabs have come into prominence since early eighties with the commencement of live crab export to the South East Asian countries which has created a renewed interest in the exploitation as well as in the production of mud crabs through aquaculture. The importance of live mud crabs as an export commodity has opened up great opportunities for crab farming. It has high demand and price in the export market.

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Mangrove associated lignite beds of Malvan, Konkan: Evidence for higher sea-level during the Late Tertiary (Neogene) along the west coast of India

Fossil pneumatophores (breathing roots) of *Avicennia* are recovered and reported from the lignite beds exposed in Kolamb well-section near Malvan, Konkan area of western Maharashtra, India. The accrued palynoflora is dominated by mangroves (*Avicennia, Aegialitis, Excoecaria, Rhizophora* and *Sonneratia*). The spores of mangrove fern (*Acrostichum aureum*) an estuarine fungus Cirrenalia indicate that these lignites are autochthonous and deposited in a near-shore environment. Presence of foraminiferal linings (= microforaminifera), dinoflagellate cysts, a few calcareous nannofossils and scolecodonts is an irrefutable proof of marine and brackish water influence during the deposition of lignites under intertidal/tidal swampy

condition (mangrove influenced) with fair input from freshwater swamps and hinterland. Freshwater-related forms, viz. *Ceratopteris thalictroides*, Nymphaeaceae, Ctenolophonaceae and hinterland taxa (Cullenia/ Durio) of Bombacaceae along with abundance of microthyriaceous fungi in the palynoflora imply a warm humid tropical climate with high precipitation during the depositional period. The presence of *Ctenolophon englerianus* (= *Ctenolophonidites costatus*) in Kolamb lignites suggests the Late Neogene (Late Miocene-Early Pliocene) age. The occurrence of pneumatophores and associated lignite deposits similar to 37 m above the present mean sea-level, and much inland, clearly indicates the higher sea-level strand during Late Neogene along the west coast of India

Current Science
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Biological active anthraquinone analogs from the fungus *Eurotium* sp.

Four known anthraquinones: Physcion, fluoroglaucin, catenarin and alaternin as well as a cyclic dipeptide with a triprenylated indole moiety, echinulin were purified from acetone extract of the mycelial mats of the fungus *Eurotium* sp. isolated from the leaves of the mangrove plant *Porteresia coarctata* (Roxb.). These compounds have previously been reported as fungal / angiosperm metabolites exhibiting anti-bacterial, anti-oxidant and cytotoxic properties. The structures of these compounds were finalized from their spectral data including 2D-NMR (COSY, HMQC and HMBC) studies, which also helped in the assignment of their proton and carbon signals.

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Use of magnetic susceptibility for identification of mangrove deposits in vibracores from deltaic environments

The most commonly used technique for retrieving sediments from modern mangroves is through the use of vibracoring equipment. The retrieved cores are small in diameter; hence conventional methods of fewer analyses are limited by sample availability. Due to the suitability of mangrove sediments for palaeomonsoon reconstruction, it becomes necessary to discriminate mangrove sediments from others. This is achieved by examining the magnetic susceptibility, chi of the cores, which show characteristically low, and invariant chi values. This criterion reliably discriminates mangrove sediments in the east coast deltaic environments of the Godavari, Krishna and Cauvery deltas highlighting the role of chi as a rapid tracer to distinguish between depositional and nondepositional environments.

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8(1): 65-70 (2004)

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INFORMATION, NEWS AND NOTES

UPCOMING RESEARCH MEETS

- 19 - 21 April, 2006. 1st International Symposium on Mangroves as Fish Habitat. Contact: Dr. Joseph E. Serafy, NOAA National Marine Fisheries Service, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, Florida 33149 USA. Phone: +1 305 361–4255 Fax: +1 305 361-4562;E-mail: mangrovesasfishhabitat @noaa.gov

- 14 - 17 May, 2006. Coastal Society 2006 Conference. Contact: Judy Tucker, Florida, USA. E-mail: coastalsoc@ aol.com.

- 14 - 19 May, 2006. 14th International Conference on Aquatic Invasive Species. Contact: Conference Administrator, International Conference on Aquatic Invasive Species 1027 Pembroke Street East, Suite 200, Pembroke, ON K8A 3M4 Canada. Phone: 800-868-8776 (North America) or 613-732-7068; Fax: 613-732-3386; E-mail: profedge@renc.igs.net.

- 22 - 25 May, 2006. Coast to Coast 2006. Contact: Coast to Coast 2006, Conference Secretariat C/- ICE Australia P/L, 6 Clarendon Place, South Melbourne , VIC 3205, Australia. Phone: +61 3 9681 6288; Fax: +61 3 9681 6653; E-mail: coasttocoast @iceaustralia. com.

- 4 - 9 June, 2006. American Society of Limnology and Oceanography Summer Meeting 2006. Contact: ASLO Business Office 5400 Bosque Blvd., Suite 680, Waco, TX 76710, USA. Phone : 1-800-929-ASLO (U.S., Canada, and Caribbean) or +1 254-399-9635 (All other countries); Fax: +1 254-776-3767; E-mail: business@aslo.org.

- 18 - 24 June, 2006. 1st Asia Pacific Coral Reef Symposium. Contact: The Secretariat, Asia-Pacific Coral Reef Symposium, C/o Dr. Put O. Ang, Jr., Department of Biology, The Chinese University of Hong Kong Shatin, N.T., Hong Kong SAR, China. E-mail: apcrs.secretariat@ cuhk.edu.hk.

- October 31–November 3, 2006. Resiliency of Gadid Stocks to Fishing and Climate Change. Contact: Sherri Pristash, Symposium Coordinator, Alaska Sea Grant College Program, University of Alaska Fairbanks, PO Box 755040, Fairbanks, AK 99775-5040, USA. Phone: 907-474-670; Fax: 907-474-6285; Email: fyconf@uaf.edu.

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