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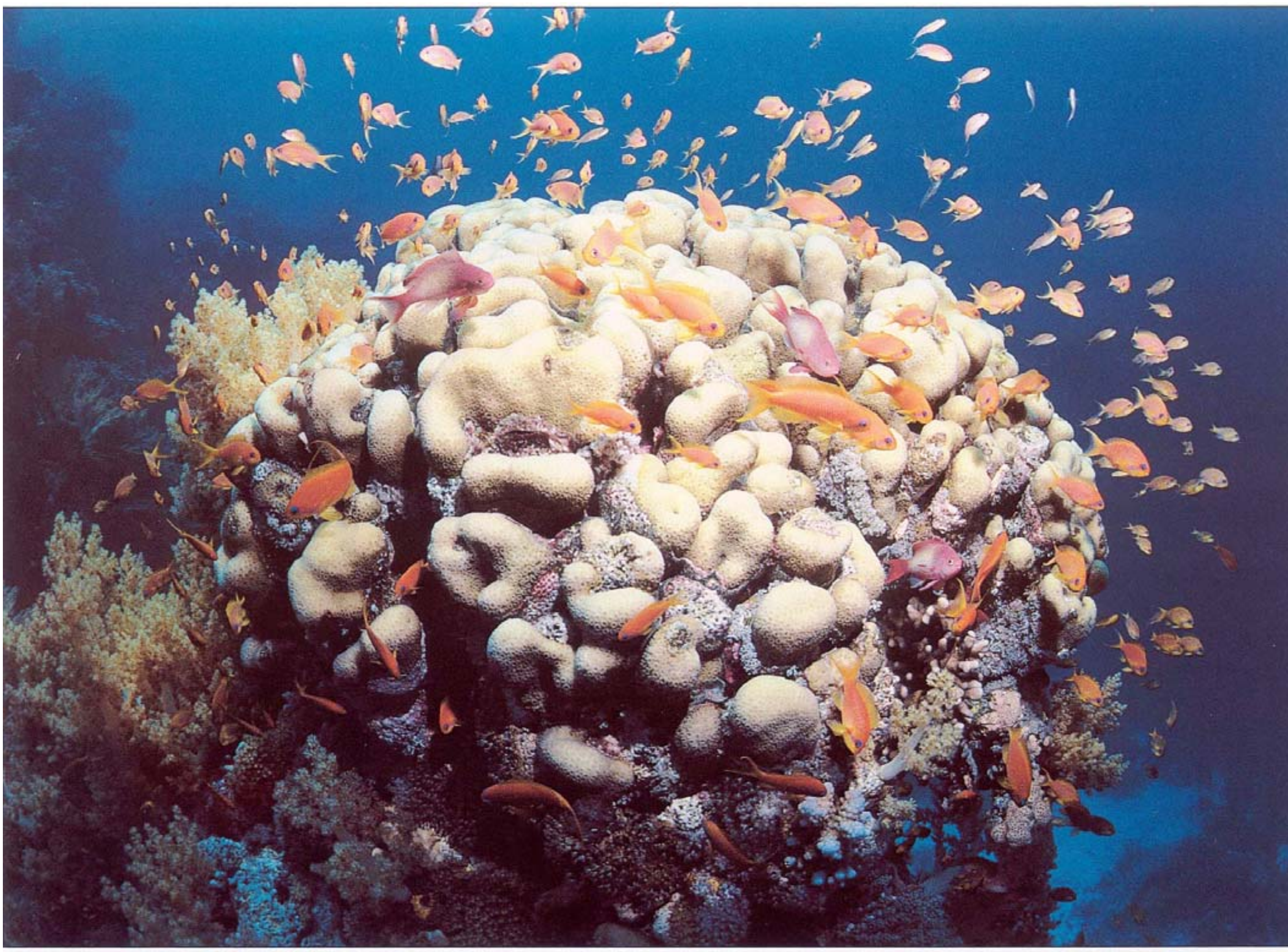
Seshaiyana

ENVIS Newsletter on Estuaries, Mangroves, Coral Reefs and Lagoons



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ENVIS Newsletter on Estuaries, Mangroves, Coral Reefs and Lagoons

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EDITORIAL

Hello Readers,

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

This issue carries information on various aspects of coastal and marine sciences. The first article lists the fishes occurring in Ayiramthengu mangrove area. Among the seventeen families recorded here, Mugilidae has been found to have the highest representation. The second article reports the stranding of the sei whale, Balaenoptera borealis in the Colachal area of Kanyakumari district. As the sei whale stranding is more on the east coast of India than on the west coast, this article suggests further studies to find out the reason. An updated information on sei whale stranding in India is is also given. Following this is an article which lays emphasis on the use of secondary metabolites as chemotaxonomic markers for the identification of mangrove species. The chemical classes and their marker compounds in different mangrove plants are also given. The fourth article lists the chemical markers in halophilic cyanobacteria and sponges. Another article furnishes information on various chemical markers which are used for the identification of halobacterial groups. The next article explains the importance of the marine ornamental fishes and the possibilities for making marine ornamental fish breeding as a lucrative industry. It also provides information on characteristics of important and interesting marine ornamental fishes. The last article elaborates the potential of sponges with respect to their biomedical compounds. This article describes more number of compounds and their activity than the earlier article which appeared in our newsletter - volume 9(1) published in 2001. The final article brings to light the occurrence of eleven species of reef fishes which were not found earlier in the Vellar estuary.

This issue also includes abstracts of recent publications on estuaries, mangroves, lagoons and coral reefs apart from forth coming research meets.

Prof. T. BALASUBRAMANIAN
Prof. S. AJMAL KHAN

Inside this issue....

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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.

Articles should be sent to:

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E-mail your articles
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Editor's desk invites reader's views, suggestions and constructive criticism on *Seshaiyana*.

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Front cover photo : Coral *Favia stelligera*
Adopted from Corals of the World by Jen Veron

CHECKLIST OF FISH FAUNA OF AYIRAMTHENGU MANGROVES, KOLLAM DISTRICT, KERALA, INDIA

Just like in any other aquatic ecosystem, fishery development, culture practices and conservation in the mangrove ecosystem should be done only with proper knowledge of the available fish fauna. No detailed scientific attempt has still been made to collect information on the fish fauna of the Ayiramthengu mangroves. Preliminary survey on the Kayamkulam estuary was carried out in 1958 (John, 1958). Water temperature of the Ayiramthengu mangroves ranged between 29.1 and 32.1°C and salinity between 7.3 and 30.3 ppt. The annual rainfall recorded was 3145.30 mm (Jisha, 2002). As no information on fish fauna of Ayiramthengu mangroves is available, a checklist has been prepared for this mangrove.

The Ayiramthengu mangrove (lat. 9° 02' - 9° 16' N and long. 76° 20' - 76° 32' E) is situated in Kollam district of Kerala, India. The mangrove ecosystem is a part of Kayamkulam estuary (lat. 9° 07' - 9° 16' N and long. 76° 20' - 76° 28' E), which is a narrow stretch of tropical backwater on the west coast of Peninsular India.

The fishes were collected from the mangrove area using an encircling net. Regular collections were made for one year. Data from secondary source have also been included (Anonymous, 2001).

Twenty seven species belonging to 17 families have been collected (Table 1). Of the 17 families, Mugilidae has the highest representation with 4 species followed by Carangidae and Cichlidae with 3 species each and Ambassidae, Gerreidae and Siganidae with 2 species each. The remaining 11 families were represented each by a single species.

The fish fauna of Ayiramthengu mangrove is composed of marine, estuarine and freshwater fishes (Table 1). These fishes can tolerate wide variations in salinity. Of the 27 species recorded, many species are commercially important (as per FAO, 1984; Jayaram, 1999; Fish Base, 2003). Like all other estuaries of Kerala, Kayamkulam estuary is also known for its rich fish fauna. Ayiramthengu mangroves skirting the

Table 1. Fish fauna of the Ayiramthengu mangroves

Sl. No.	Scientific name	Family	Environment	Importance
1	*Liza parsia* (Ham.-Buch.)	Mugilidae	M, E, FW	C
2	*L. tade* (Forsskal)	”	M, E, FW	C
3	*Mugil cephalus* Linn.	”	M, E, FW	C
4	*M. dussumieri* Valenciennes	”	M, E, FW	C
5	*Caranx carangus* = *C. hippos* (Linnaeus)	Carangidae	M, E	C
6	*C. melampygus* Cuvier	”	M, E	C, O
7	*Carangoides malabaricus* (Bloch & Schneider)	”	M	C
8	*Etroplus maculates* (Bloch)	Cichlidae	E, FW	LC, O
9	*E. suratensis* (Bloch)	”	E, FW	C, O
10	*Oreochromis mossambicus* (Peters)	”	E, FW	C, O
11	*Ambassis commersonii* (Cuvier)	Chandidae	M, E	C
12	*A. gymnocephalus* (Lacepede)	”	M, E	LC
13	*Gerres filamentosus* (Cuvier)	Gerreidae	M, E	LC
14	*G. oblongus* Cuvier	”	M	C
15	*Siganus javus* (Linn.)	Siganidae	M, E	C, O
16	*S. sutor* (Valenciennes)	”	M, E	C
17	*Acanthurus* sp.	Acanthuridae	M	C, O
18	*Aplocheilus* sp.	Aplocheilidae	M	-
19	*Arothron leopardus* (Day)	Tetraodontidae	M, E	O
20	*Epinephelus malabaricus* (Bloch & Schneider)	Serranidae	M	C
21	*Glossogobius giuris* (Ham.-Buch.)	Gobiidae	M, E, FW	LC, O
22	*Leiognathus splendens* (Cuvier)	Leiognathidae	M, E	C
23	*Lutjanus johnii* (Bloch)	Lutjanidae	M, E	C
24	*Platax teira* (Forsskal)	Ephippidae	M	O
25	*Scatophagus argus* (Bloch)	Scatophagidae	M, E	O
26	*Solea ovata* Richardson	Soleidae	M	C
27	*Therapon jarbua* (Forsskal)	Theraponidae	M, E	LC, O

M – Marine, E – Estuarine, FW – Freshwater, C – Commercial, O – Ornamental, LC – Less Commercial Importance

Kayamkulam estuary contribute much to the fishery wealth of this estuary.

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STRANDING OF A SEI WHALE, *BALAENOPTERA BOREALIS* LESSON AT KURUMPANI NEAR COLACHAL, KANYAKUMARI, TAMIL NADU

Instances of whales getting stranded in shallow waters and subsequently washed ashore along the coasts of India are common. Further, the frequency of such stranding along the east coast is more than that on the west coast. This is the 13th record of stranding of sei whale from the coasts of India.

The news about stranding of a whale in between the sea shore of Mela Medalam and Kurumpani fishing villages, near Colachal, Kanyakumari district appeared in the local dailies on 26.8.2003, and a visit was made to collect information on the stranded whale. Enquiries with the local fishermen revealed that the whale had died a few days ago, most probably due to a wound caused by collision with a ship and got washed ashore on 24.8.2003. The whale was identified as the male of *Balaenoptera borealis* based on 52 ventral grooves (James and Lal Mohan, 1987). It measured 8.37m in total length and weighed about 9 tonnes (Fig. 1).

The specimen which started decomposing was found partly submerged in the water. Few measurements made are presented in Table 1. Arrangements were made by the State Fisheries Department to bury the carcass of the whale at the beach itself.

Fig. 1. Sei whale, *Balaenoptera borealis* Lesson stranded at Kurumpani, near Kanyakumari

Table 1. Morphometric measurements (in cm) of sei whale *Balaenoptera borealis* Lesson stranded near Colachal

Sl. No.	Morphometric characters	Measurements (cm)
1	Total length (tip of upper jaw to deepest of the part fluke notch)	837
2	Tip of upper jaw to center of anus	589
3	Maximum body diameter	300
4	Length of upper jaw	310
5	Length of lower jaw	270
6	Length of each flipper	180
7	Flipper width	75
8	Number of ventral grooves	52
9	Sex	Male
10	Estimated weight in tones	9

Our knowledge about the stranding of whales along Kanyakumari district is restricted to the report on stranding of two false killer whales *Pseudorca crassidens* at Pozhikara (Silas and Pillay, 1961) and young *Balaenoptera physalus* at Kanyakumari (Joel *et al*., 1996). The present note deals with stranding of sei whale *B. borealis* for the first time along Kanyakumari coast. An update of stranding of sei whale *B. borealis* along the Indian coasts is given in Table 2. From the table it is clear that 84.6% of the stranding of *B. borealis* has been reported from the east coast. Why more stranding along the east coast of India and not on the west coast?. This requires detailed investigation.

Table 2. Stranding of sei whale *Balaenoptera borealis* Lesson along the coasts of India

Date of stranding	Place	Dead / alive	Total length (m)	Weight (in t)	Sex	Reference
23.12.1971 (stranded)	Manakad, Mandapam	Dead	15.53	-	-	Venkataraman, G., *et al.*, 1973. Indian J. Fish., 20(2): 634–638.
31.01.1981 (stranded)	Mallipatnam, Tanjavur Dist.	Dead	9.90	-	-	James, P.S.B.R. and R. Soundarajan, 1980. J. mar. biol. Ass. India, 22(1&2): 175.
18.03.1983 (stranded)	Dhanushkodi	Dead	13.80	-	-	James, P.S.B.R. and Lal Mohan, 1987. Mar. Fish. Infor. Serv. T.&E. Ser., 71: 1–16.
26.02.1988 (washed ashore)	Tuticorin	Dead	12.00	-	Male	Venkataramanujam, K., *et al.*, 1988. Investigation on Cetaceae, 21: 247–249.
18.05.1988 (stranded)	Kayalpatnam	Dead	10.02	5.5	Female	Mohamed Kasim, H. and T.S. Balasubramanian, 1989. Mar. Fish. Infor. Serv. T.&E. Ser., 95: 12–14.
May, 1988 (brought to shore)	Tuticorin	-	7.50	-	Male	CMFRI Newsletter, 1988. By Staff of CMFRI, Madras, No.48.
14.8.1988	Sikka off Gulf of Kachchh	-	9.76	4.5	Female	CMFRI Newsletter, 1988. By Staff of CMFRI, Madras, No.41.
27.01.1990 (brought to shore)	Pamban	-	11.4	7.0	Female	Krishnapillai, S., A.A. Jayaprakash, C. Kasinathan and N. Ramamoorthy, 1995. Mar. Fish. Infor. Serv. T.&E. Ser., 139: 11 pp.
21.01.1992 (washed ashore)	Theedai	-	14.00	-	Female	Nammalwar, P., *et al.,* 1992. Mar. Fish. Infor. Serv. T.&E. Ser., 117: 18–19.
12.2.1999	Vellapatti (Gulf of Mannar)	-	13.58	12	-	Balasubramaniam, T.S., 2000. Mar. Fish. Infor. Serv. T.&E. Ser., 163: 13–14.
1.6.2000	Tuticorin	Alive	9.5	8	Female	Balasubramaniam, T.S., 2001. Mar. Fish. Infor. Serv. T.&E. Ser., 167: 14–15.
26.7.2001	Pirappan valasai Palk Bay near Mandapam	-	9.0	8	Male	Gandhi, V. and C. Kasinathan, 2002. Mar. Fish. Infor. Serv. T.&E. Ser., 173: 4 pp.
26.8.2003	Kurumpani, K.K. Dist.	Dead	8.37	9	Male	Present report

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Modern phytochemistry is often connected with plant taxonomy and is helpful to taxonomists in their endeavour to arrive at natural classification of many groups of plants. Comparative phytochemistry combined with an adequate plant classification is an excellent guide for the chemical exploration of the plant world.

Of the plant chemicals, secondary metabolites are important as they are synthesized largely in higher plants. The secondary metabolites vary in their distribution and composition, according to the age, habitat and parts of plants. The secondary metabolites are of varied functions in plants as defense (against herbivores, microbes, viruses or competing plants), signal compounds (to attract pollination or seed dispersing animals) and in survival, reproductive fitness and adaptive characters of the plants (Wink, 2003). The secondary metabolites such as quinolizidine, alkaloids, non-protein amino acids, tropane, steroidal alkaloids, essential oils, anthroquinones and flavonoids have contributed considerably to classification and evolution of the family. The distribution of the chemical compounds appears to be almost mutually exclusive among the plant

Table 1. Identified chemical markers in mangrove halophytes

Mangrove species	Chemical classes	Marker compounds
Xylocarpus granatum	Alkaloids	N- methyl flindersine
X. moluccensis	Monoterpenoids, Liminoids	Xylomollin, Xyloccensis1,2
Fagara zanthoxyloides	Alkaloids	Fagaronine
Pongamia pinnata (mangrove minor)	Isoflavones	Chalcone
Aglaia odorata (mangrove associate)	Benzofuran derivatives	Rocaglamide
Bruguiera cylindrica	1,2 -dithiolane	Brugierol
B. sexangula	Alkaloids	Tricin, Brugine, Gerradine
B. gymnorrhiza	Diterpenes	Giberellin-A3 GiberellinA7
Heritiera littoralis	Sesquiterpenoid Triterpenes	Vallapin, Vallapianin Heritianin, Heritol Stigmasteryl β-D-glucopyranoside
Excoecaria agallocha	-	Excoecaria toxin, Excoecarian
Hibiscus tiliaceus	Sesquiterpenoidal quinone	Lapachol, Hibiscone
Thespesia populnea	Quinones	Mansonones
Dalbergia ecastophyllum	Flavonoids	Chalcones
Intsia bijuga	Polyphenols	Leucocyanidins, Stilbenes
Kandelia rheedii	Anthocyanins	-
Rhizophora gymnorrhiza	Procyanidins	-
R. stylosa	Flavoglycans	-
R. mucronata	Alkaloids	Rhizophorine
R. apiculata	Diterpenes Triterpenes	1-hydroxy- epimanoyl oxide Taraxeryl cis-p-hydroxy cinnamate
Sonneratia acida	Anthraquinones Phenolic compound	- 2- nitro 4-(2'nitro ethenyl) phenol
S. alba	Cyclitol, polyol	-
S. apetala	Anthraquinones	-
Aegiceras corniculatum	Benzoquinone	5-O-methylembelin, embelin
Acanthus illicifolius	Triterpenes Alkaloids	Olean-12-en-28 oic acid, 3-hydroxyD-glucopyranosyl ester, Benzoxazolin-2-one

families, implying a strong phylogenetic and ecological trend. Thus, the distribution of secondary metabolites has some value in taxonomy but their occurrence apparently reflects adaptation and life strategy in a given phylogenetic framework.

Mangrove halophytes are rich in secondary metabolites (Bandaranayake, 2002). Since time immemorial, the mangrove species have been identified based on morphological and histological characteristics. However, many taxonomic confusions still exist in mangroves. For example, *Acrostichum* species are still poorly identified. *Sonneratia lanceolata* and *S. caseolaris* in Australia lack clear distinction in descriptions from Indonesia and Southeast Asia. *Rhizophora apiculata* has under-leaf spots from Indo-Malaysia, but not in northern Australia. *Rhizophora mucronata* from east Africa and Southeast Asia is not distinct from *R. stylosa*. *Acanthus ilicifolius* is not clearly identified from *A. ebracteatus*. For some species like *Avicennia marina* and *Ceriops tagal*, ecological varieties need to be recognized. In addition, there are several natural hybrids, but their parental species are not clearly understood, especially for species of *Rhizophora*. Another problem in the taxonomy of mangroves is the confusion between the species of true mangroves and mangrove associates. Besides, often the same species is named differently at different sites, as in the case of *Avicennia rumphiana* and *A. lanata*. To resolve the taxonomic disputes, chemotaxonomic markers need to be considered. Genetic variability has recently been demonstrated through chemical markers such as iridoid glycosides, leaf waxes and isoenzymes (Kathiresan and Bingham, 2001). In fact, the secondary metabolites have not been utilized properly for mangrove taxonomy. Therefore, secondary metabolites in mangrove are highlighted for their possible utility as chemotaxonomic markers (Table 1).

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IDENTIFIED CHEMICAL MARKERS IN HALOPHILIC CYANOBACTERIA AND SPONGES

Biomarkers are compounds or groups of compounds that can be used as signatures of individual organisms or group of organisms or of certain environmental processes (Parrish *et al.*, 2000). They can be signatures of the condition of a sample and certain compounds are used as early warning signals. Both molecular and isotopic analyses of biomarkers have been extensively used in geochemical studies (Villanuera *et al.*, 1997; Guzman-Vega and Mello, 1990) and there is increasing interest now in their use in ecological studies. This article mainly focuses on the smaller chemical molecules that are determined using standard chromatographic techniques. Chemical markers include lipids, phenols, steroids, peptides, alkaloids, saccharides, fatty acids etc. Marine sponges are known to posses a variety of bioactive principles like Halichondrin – B which is identified as progressible hit in marine drug discovery process. Such specific markers in marine organisms are prerequisite for the standardization and formulation of marine drugs. Some of the chemical constituents and compound classes already reported by several workers are listed in Tables 1&2. These could be used as markers either in drug development programmes or chemotaxonomic studies. Further studies are needed for confirming the identified chemical markers among known species of marine organisms.

Table 1. Biochemical markers in halophilic cyanobacteria

Organisms	Chemical constituents	Marker compounds
Order: Chroococcales		
Aphanothece sp.	Alkane	Poly-3-hydroxy alkanotes
Microcystis aeruginosa	Lipopeptide	Aeruginosin Kawaguchipeptin Microcystilide Microviridin Micropeptin
M. wesenburgii	Cyclocitral	β-cyclocitral
Synechococcus sp.	Fatty acid	Linolenic acids
Synechocystis sp.	Triterpenoid	35-o-β-6-amino-6-deoxy glycopyranosyl bacteriohopanotetrol
S. trididemni	Lipopeptide	Didemnin
Order: Pleurocapsales		
Hyella caesptiose	Alkaloids	Carazostatin Chlorohyellazole
Order: Oscillatoriales		
Lyngbya gracilis	Alkaloids	Azabicyclononane
L. lagerheimii	Lipid	Sulfolipid
L. majuscula	Amides	Apramide Barbamide Carmabine Curacin Dolastin Frontalin etc
Oscillatoria acutissima	Ketals	Acutiphycin
O. agardhii	Lipopeptide	Agardhipeptin
O. raoi	Lipopeptide	Raocyclamide digalacto lipids
Phormidium octocarpi	Phenol derivatives	Hierridin,2,4-dimethoxy-6-heptadecyl phenol
P. tenue	Fatty acids	Sulfolipid
Plectonema radiosum	Cipopeptid	Tubercidin
Schizothrix calcicola	Indole	E-1-chlorotridec-1-ene 6,8-diol
Spirulina platensis	Saccharides	Calcium spirulan Poly-β-hydroxy
Symploca hydnoides	Lipopeptide	Symplostatin
Trididemnum solidum	Nickel chlorins	Acyltunichlorin
Order: Nostacales		
Anabaena basta	Lipopeptide	Bastadin
A. circinalis	Lipopeptide	Circinamide
A. flos-aquae	Alkaloid	2:9 Diacetyl 9 Azabicyclol (4:21)non-2:3 ene
A. variabilis	Lipopeptide	Plastocyanins

Aphanizomenon flos-aquae	Aromatic pyrole lipopeptide	Aphanorphine
Cylindrospermum licheniformis	Alkaloid	Cylindrocyclophane
Hormothamnion enteromorphoides	Lipopeptide	Hormothamnin
Nodularia spumigena	Lipopeptide	Nodulapeptin Spumigan
Nostoc commune	Lipopeptide	Nostodione
N. linckia	Esters	Borophycin
N. muscorum	Lipopeptide	Muscoride
N. sphaericum	Indoles	Saturosporine
N. spongiaeforme	Lipopeptide	Nostocine A
Rivularia firma	Indoles	Polybrominated bisindoles
Scytonema mirabile	Alkaloids	Didehydromirabazole
Tolypothrix conglotinata	1-3, polyols	Nanomethoxy-1-pentacosene
T. tenuis	Nucleosides	Toyocamycin
Order: Stigonematales		
Fischerella muscicola	Lipopeptide	Fischerellin
Hapalosiphon fontinalis	Alkaloids	Anhydrohepaloxindle
H. welwitschii	Alkaloid	Hapalosin
Prochlorothrix hollandica	Terpenes	Triterpenoids (hopanes)
Stigonema dendroideum	Lipopeptide	Dendroamide
Westiellopsis prolificans	Lipopeptide	Westiellamide

Table 2. Biochemical markers in marine sponges

Organisms	Chemical constituents	Marker compounds
Agelas mauritianus	Undetermined	α-galactosylceramide
Petrosia contignata	Contignasterol	Undetermined
Luffariella variabilis	Manoalide	Undetermined
Lissodendoryx sp.	Undetermined	Halichondrin-B
Halichondria sp.	Okadaic acid	Undetermined
Dysidea herbacea	Sesquiterpenes	Spirodysin
Theonella swinhoei	Herbadysidolide	Undetermined
Discodemia dissolute	Dicodermolide	Undetermined
Dysidea avara	Undetermined	2-methylthio- 1,4- napthoquinone
Sigmadosia domuncula	Lectin	Undetermined
Aplysina cavernicola	Undetermined Undetermined	Dichloroverongiaquinol Aerophysinin, Aerothionin
A. aerophoba	Undetermined	Aerophysinin-I
Verongia thiona	Undetermined	Aerothionin
Rhopaloeides odorabile	Diterpene	Undetermined
Kirkpatrickia varialosa	Undetermined	Variolin B
Acanthella cavernosa	Terpenoids	Undetermined
Cacospongia linteiformis	Sesterterpenes	Undetermined
Dysidea sp.	Undetermined	Diphenylethers
Theonella swinhoe	Swinholides	Undetermined
Jaspis sp.	Cyclodepsipeptide	Jaspamide

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LIPID BIOMARKERS FOR HALOBACTERIAL CHEMOTAXONOMY

Identification of fresh isolates from microbes is a continuing task for marine microbiologists. Identification of marine bacteria is commonly based on a wide range of biochemical and physiological tests and it takes time. It is also problematic due to lack of agreement between the results of biochemical tests. The reason stems from the differences in the biochemical features of fresh and stored isolates (Akagawa – Matsushita *et al.*, 1992). In fact, plasmid DNA is lost during storage. Recent advances in the biochemistry of microorganisms have shown that analysis of cell components such as proteins and fatty acids provides the basis for chemotaxonomy which can be effectively used in bacterial identification (Goodfellow and Minnikin, 1985).

Halophilic microorganisms may belong to any of the three domains of life. Archea, Bacteria and Eukarya. Many groups of microorganisms possess characteristic lipid components (White *et al.*, 1996). The halophilic archea are characterized by the possession of diphytanyl-or phytanyl-sesterterpanyl diether lipids. These are fundamentally different from the straight chain fatty acid glycerol ester lipids of the Bacteria and Eukarya. At least 12 different glycolipids have been described from halophilic archea, with or without sulphate groups (Oren, 2001). Many of these glycolipids are diagnostic for certain genera or even species. Therefore, the spectrum of polar lipids extracted from hypersaline environments yields information on the types of halophilic archea present in the community. Halophilic microorganisms are often pigmented. Many contain high concentration of carotenoids. Thus most members of the Halobacteriaceae are coloured red due to a high content of 50 – carbon carotenoids of bacterioruberin series. Photosynthetic bacteria (Eg. Cyanobacteria) and Eukarya (Eg. *Dunaliella*) may also contribute to the pigmentation.

Lipids have been widely used as biomarkers in the characterization of the microbial communities in aquatic systems, sediments and other environments (White *et al.,* 1996). Analysis of polar lipids can be exploited to obtain information on the community structure of halophilic archea. The unique chemical classes in the respective bacterial isolates represented in Table 1 could be used as reference for better identification of marine bacterial species.

Table 1. Determined chemical markers in salt tolerant bacteria

Bacterial species	Unique chemical markers
Halobacteriaceae	
Halobacterium spp.	Sn-2, 3-di-O-Phytanyl-1-phosphoglycerol-3-phospho-sn-2, 3-di-O-phytanyl glycerol (BPG)
Haloarcula spp.	Triglyceryl derivatives (TG-D-2)
Haloferax spp.	Sulphated – Diglycosyl derivatives – 1 (S-DGD-1)
Methanotrophs	
Methylococcus rubra	Hexadecenoic acids (C_{16} : 1)
Methylosinus trichosporum	Phosphatidyl dimethyl ethanolamide (C_{18} : 1) fatty acids
Marine bacteria	
Alteromonas spp.	Saturated 16 : 0
Deleya spp.	Saturated 16 : 0 and 12 : 0 3OH
Oceanospirillum spp.	Monounsaturated 16 : 1- cis 9
Vibrio spp.	Unsaturated 16 : 1 – cis 9

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Marine aquarium trade is rapidly expanding and there is a growing demand for tropical marine aquarium fishes in the international market. Globally, the aquarium industry is valued at $4 to $15 billion. In USA, 89 million freshwater fishes are being maintained in 12.1 million tanks while 5.6 million tropical marine fishes, in 1.1 million tanks (Hoff, 1996). In India, the scientific and technological advancements have led to an increased demand for tropical marine aquarium fishes in the recent years and this has opened up new avenues for developing a lucrative and money – spinning trade for marine ornamental fishes.

Marine ornamental fishes are said to have association with the coral seas. Since the coral reef environs can provide with a wide variety of ecological niches for shelter as well as food, extremely rich and varied animal communities with great diversity of species can thrive here. About 400 species of ornamental fishes belonging to 175 genera and 50 families are reported in Indian waters. But this figure is on the rise as more number of surveys are being made in different coral locations of the country (Satheesh, 2002).

Details of some of the interesting ornamental fishes are given below:

Salt water guppys 'Clown fishes' (Family : Pomacentridae) are the major attractive tropical marine fishes. The curious waddling swimming action of the anemone fishes, together with clearly defined body markings, have given them the name clown fish. They live in association with anemones. These fishes have acquired natural protection from the paralyzing filaments of anemones by having a mucous layer that covers the body of the fish. The technology for captive breeding and rearing was developed for this fish. Due to the small size, hardy nature and adaptability to live in captivity, it is most popular in home aquaria.

Similarly, the 'Damsel fishes' (Family : Pomacentridae) which have attractive colours like blue, black, green, yellow tail etc. live among the branches of the corals. They are highly suitable for home aquaria. Sergent major of Pomacentridae is a small and highly coloured damsel fish suitable for aquarium.

The most spectacular fish Moorish idol (Family : Zanclidae) is a gift from the paradise coral reef. It is highly sensitive and its dorsal and anal fins are long and swept back. The most striking feature of this fish is its colour pattern and its body being white and pale yellow with broad bands of brownish black colour running from the top to bottom.

Lion fish (Family : Scorpaenidae) is the wild beauty of the coral paradise. It owes its name to its spreading pectoral and dorsal fins and also its venomous nature. It is a predatory fish that often hunts its prey in a group. The body has striped, zebra like markings brightly coloured with red and white stripes. This most showy fish is also called the turkey fish, zebra fish, scorpion fish and dragon fish.

Parrot fishes (Family : Scaridae) are kept in aquaria for their attractive parrot like beaks which are formed of fused teeth used for cushing the hard skeletons of the reef forming corals to get at the soft animals inside.

Box fishes or trunk fishes (Family : Ostraciidae) have a hard outer case that completely encloses the body. These fishes are poor swimmers and they propel themselves with their caudal and pectoral fins. They have fanciful colours.

Marine angels (Family : Pomacanthidae) live largely in pairs or small groups in the coral reef area. The outstanding feature of these fishes is their indescribable beauty and wide range of colour patterns. The most familiar and attractive fish "Khuran angel" has ornamented markings on the caudal fin which is said to resemble old Arabic characters on one side of the tail "Laillah illalah" and on the others side "Shani Alla".

Butterflies (Family : Chaetodontidae) are small, less hardy but very beautiful, swift and abundantly seen fishes over the reefs. Due to their bright colours, they are named as butterfly fish. They are relatively small, and highly compressed (bilaterally) so that they swim like a standing disk. About 20 species of butterfly fishes in varying colours are reported in Indian waters.

Cleaner wrass (Family : Labridae) spends much of its time in picking parasites from other large fishes thereby the cleanliness is being maintained. So, it is suitable for aquaria and is in great demand that its numbers have decreased in some of the important collection spots around the world.

The cardinal fishes (Family : Apogonidae) are small reef dwellers. Usually they are red and some are brownish in colour living in and around coral reefs. Most of the cardinal fishes carry their eggs in their mouth until they hatch out.

Surgeon fish (Family : Acanthuridae) has knife like spine on each side near the tail that can cut one's flesh like a surgeon's scalpel. Normally the spines are folded and they are lifted when the fish is troubled. They are brightly coloured fishes having the capacity to change their colour frequently. Its body is deep and flattened from one side to the other and almost oval in out line except for the tail fin.

Hawk fishes (Family : Cirrhitidae) are colourful fishes which spend most of their time resting or lying on bits of coral.

Bat fishes (Family : Ephippidae) are deep bodied with small mouth. When young these fishes are most attractive.

Puffer fishes (Family: Tetraodontidae) are also known by other names such as balloon fishes, swell fishes, globe fishes and blow fishes. All these names express the outstanding feature of the fish i.e. they can blow themselves up to twice or more their normal size.

Seahorses (Family : Syngnathidae) are other peculiar fishes that are completely different from other fishes in shape. They swim in an upright position. The female lays her eggs in the pouch of the male frond where the babies emerge as miniature adults.

Attractive tangs, Sweet lips, Snappers, Squirrels, Triggers, Banners, Marine angels etc., with glowing colours are the other beautiful ornamental fishes, dwelling in the coral paradise.

Besides fishes, shrimps such as Doctor shrimps are beautifully coloured animals which remove ectoparasites and dirt, from the corals. Captive breeding is possible in these species.

Let us promote the marine aquarium fish trade, using the above fishes, but with a determination not to affect the species diversity of the wonderful coral reef environment.

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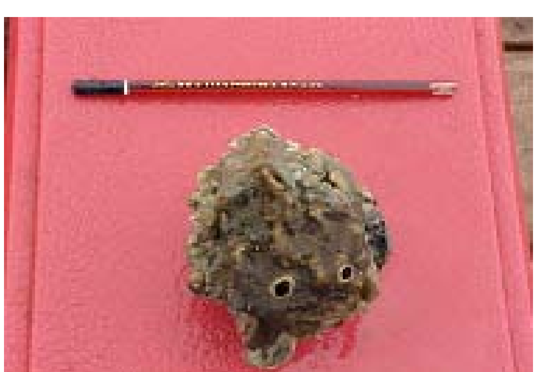
SPONGES-STORE HOUSES OF VALUABLE COMPOUNDS

There are approximately 15,000 species of marine and freshwater sponges recorded in the world. Among these, only 8000 were identified as "valid" species from the seas and lakes. Sponges are ubiquitous benthic creatures, found at all latitudes beneath the world oceans, and from the intertidal area to the deep sea. The ocean is the source of a large group of structurally unique natural products that are mainly accumulated in the marine organisms. In Indian waters about 610 species have so for been recorded from both the east and west coasts. They are abundant in the regions of Gulf of Mannar, Palk Bay and Laccadive Archipelago of India. The drug potential of these 'wonder-compounds' has triggered a worldwide interest in this group. The natural products derived from plants and animals have long been of significant biomedical value and crude products isolated from marine organisms have served as a source of many drugs (Kamboj, 1999).

Phylum Porifera is one of the few animal phyla with a widely accepted common name: the sponge. The name Porifera stems from the numerous pores, holes and channels that perforate the body of sponges. These are the most primitive of the multicellular animals. All members of this phylum are sessile and exhibit little detectable movements. Among the various orders of sponges, siliceous sponges constitute the bulk (95%) of the total number of species. Sponges, attached to the seabed or other substrates for most of their lives may have larvae that are motile, swimming or crawling away from their parent. Sponges are also ecologically significant, being the second most common (and diverse) group of animals in coral reefs, and sometimes the most common group of animals living between the reefs. In general, sponges are proving to be extremely useful to the pharmaceutical industry.

Sponges contain variety of antibiotic, antibacterial, antifungal, antineoplastic substances, pigments, unique chemicals such as sterols, toxins and even anti-inflammatory and anti-arthiritic compounds. Sponges have come to lime light in 1950's with the discovery of arabinose nucleosides. Recent reports showed that this group (sponges) is the foremost among all the marine groups with many compounds having respiratory, cardiovascular gastrointestinal, anti-inflammatory and antibiotic properties useful to Man. The discovery of arabinose nucleosides (Bergmann and Feeney, 1951) from the sponge, *Tethya crypta* with biomedical properties has triggered off a worldwide interest in the biochemistry of this group in general. This compound is now used as potent antiviral and antitumor drugs and are also used for various chemical purposes.

Common species of sponges in Palk Bay, Tamil Nadu



Spirastrella inconstans

Callyspongia diffusa

Considering the pivotal role of sponges in the study of marine products chemistry, various compounds having biomedical potential isolated from sponges in the recent past, are presented in Table 1.

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Table 1. Biomedical potential of sponges

Species	Compound name	Compound effect
Axinyssa sp.	Axinyssene	Mild cytotoxic
Veronid sp.	Nakirodin A	’’
Luffariella sp.	Luffariolide (H&J) Geometricin A	Mild cytotoxic Moderate cytotoxicity, anti-algal
Leucetta sp.	Leucamide	’’
Petrosia sp.	Lembehsterols (A&B)	Cytotoxic
Ircinia sp.	Cyclotheonamide (E4&E5)	
Axinella sp.	Axinellamine (A&D)	Bacteriocidal
Adocia sp.	Adociasulfate	Cytotoxic
Suberea sp.	Suberedamine (A&B)	Cytotoxic
Ulosa sp.	Ulosin (A&B), others	Cytotoxic
Epipolasis sp.	24-isopropylcholesterol 24-isopropenylcholesterol	Antimalarial
Dactylospongia sp.	Pelorol, ilimaquinone	Low antimicrobial and low cytotoxiccity
Amphimedon sp.	Pyrinodemin (A-D)	Cytotoxic
Hyrtios sp.	Isodehydroluffariellolide homofascaplysin A fascaplysin	’’
Dysidea spp.	Biprasin	Caffeine-like, calcium release
D. cineria	-	Cytotoxic, Anti HIV
D. avara	-	Anti HIV
Agelasnakamurai sp.	Mukanadins (A-C)	Caffeine-like, calcium release
Xestospongia sp.	Xestoquinone	Cytotoxic
Spongosorites sp.	Dragmacidin	’’
Aplysina sp.	Aeroplyseinin 1	’’
Psammaplysilla purpurea	-	ATPase inhibitor
Spongia officinalis	-	Toxic to brine shrimp
Leiosela lavis	-	Antitumor, Anti HIV, Anti helmintic
Hyattella sp.	-	K B Cell inhibitor

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OCCURRENCE OF REEF ASSOCIATED FISHES IN VELLAR ESTUARY, SOUTHEAST COAST OF INDIA

Estuaries have long been considered as the most productive and architecturally complex among the coastal ecosystems. They are able to support diverse fish assemblages and act as nursery grounds for juveniles of many commercially important fish species. Communities of fish inhabiting estuaries are a combination of freshwater and marine species including juveniles which exhibit wide tolerance to fluctuating environmental conditions typical of these systems. The main environmental parameters known to affect the spatial organization of estuarine communities are salinity and depth. Other factors such as temperature, turbidity, and some components of the habitat, such as benthic community composition and substrate type further influence this organization.

The Vellar estuary (lat. 11° 29'N – long. 79° 46'E) supports traditional fisheries of the Parangipettai coast. Many research reports, published earlier have information on the diversity of fishes in Vellar estuary. However, most of these only list common estuarine fishes, which have food value. No information is available regarding the reef associated fishes in this estuary except *Acanthurus xanthopterus*. This estuary has two bridges, one the boat jetty and another the railway bridge. The boat jetty closer to our centre is in the tidal zone of the estuary and is separated from the latter in the gradient zone by a distance of 1.8 km. The pillars of these bridges have dense mussel and oyster colonies which serve as a good habitat for many fishes. Around the pillars of these bridges, reef fishes are found. These fishes could not be collected using the traditional fishing gears deployed in this estuary like cast net and gill net. Hence 'fish traps' used for reef fishing were obtained from Gulf of Mannar region and operated near the pillars with meat baits. Traps were observed for the presence of fish at the interval of 6 hours. The trapped fishes were collected, preserved and identified up to species level using the 'Fish Base 2000' interactive data accessing software.

A total of 11 fish species (Table 1) belonging to 10 families were identified during the present study carried out for a period of 4 months from May to August, 2004. All these species collected presently from Vellar were coral reef associated forms and these have not been previously recorded in Vellar estuary. Yellow fin surgeon fish was found to be the most abundant one. All the other species were represented by very few numbers and in many instances a single representative was there.

The occurrence of reef fishes in Vellar estuary is presumably attributed to the presence of a coral reef in Parangipettai coastal waters. However the depth and extent of the reef is not known (Reef Base, 2000). Detailed study on diversity of fishes in this coral reef vis-à-vis reef fish diversity in Vellar estuary will add to your understanding of reef fish resource in Parangipettai waters.

Table 1. List of reef associated fishes collected from Vellar estuary

S.No	Family	Scientific name	Common name
1	Chaetodontidae	*Chaetodon vagabundus* Linnaeus	Vagabond butterfly fish
2	Chaetodontidae	*Heniochus acuminatus* Linnaeus	Pennat coral fish
3	Pomacentridae	*Abudefduf vaigiensis* Quoy and Gaimard	Sergent major
4	Serranidae	*Ephinephelus solmonides* Lacepede	Gold spot grouper
5	Drepanidae	*Drepane punctatus* Linnaeus	Spotted sickle fish
6	Acanthuridae	*Acanthurus xanthopterus* Valenciennes	Yellow fin surgeon fish
7	Synanceiidae	*Synanceia verucosa* Bloch and Schneider	Stone fish
8	Labridae	*Thalassoma lunare* Linnaeus	Moon wrasse
9	Ephippidae	*Platax orbicularis* Forsskal	Orbicular bat fish
10	Balistidae	*Pseudobalistes flavimarginatus* Ruppell	Yellow margin trigger fish
11	Scorpaenidae	*Pterois volitons* Linnaeus	Red lion fish

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ABSTRACTS OF RECENT PUBLICATIONS

ESTUARINE BIOLOGY

Ceriopsins F and G, diterpenoids from *Ceriops decandra*

Chemical examination of the ethyl acetate solubles of the CH sub(3)OH:CH sub(2)Cl sub(2) (1:1) extract of the roots of *Ceriops decandra* collected from Kauvery estuary resulted in the isolation of two more diterpenoids, ceriopsins F and G (1-2) and five known compounds, ent-13- hydroxy-16-kauren-19-oic acid (steviol, 3), methyl ent-16 beta ,17- dihydroxy-9(11)-kauren-19-oate (4), ent-16 beta ,17-dihydroxy-9(11)-kauren- 19-oic acid (5), ent-16-oxobeyeran-19-oic acid (isosteviol, 6), 8,15R- epoxypimaran-16-ol (7). The structures of the new diterpenoids were elucidated by a study of their physical and spectral data as methyl ent-13,17-epoxy-16- hydroxykauran-19-oate (1) and ent-16-oxobeyeran-19-al (2).

Phytochemistry
62(8): 1207-1211 (2003)

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Review of the glassfishes (Perciformes: Ambassidae) of the western Indian Ocean

Seven species of the glassfish belonging to genus *Ambassis* occur in brackish to marine habitats of the western Indian Ocean, mostly along sandy shores, mangrove stands and in estuaries. The earliest available name for an ambassid, *Lutjanus gymnocephalus* Lacepede, 1802, has presented nomenclatural problems and is designated a nomen dubium. The ambassid species in the area, from the southern tip of India to southeastern Africa, including all intervening islands, are: *A. dussumieri* (East Africa to China), *A. fontoynonti* (endemic to eastern Madagascar), *A. urotaenia* (Indo-West Pacific, but not known from coastal Africa), *A. interrupta* (western India to southwestern Pacific islands), *A. nalua* (western India and throughout Australasia), and *A. ambassis* and *A. natalensis*, both East Africa, Madagascar, Mauritius and Reunion (the last unconfirmed for *A. natalensis*).

Cybium
27(3): 199-209 (2003)

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Pattern of species succession of soft-bottom macrofauna in the estuaries of Goa, west coast of India

Multivariate techniques, chord normalized expected species shared (CNESS) and principal component analyses of hypergeometric probability of species matrices (PCA-H) were applied to soft-bottom macrofauna data of Goa estuaries, west coast of India, to assess the pattern of species succession at different sites. These analyses revealed three groups of species that produced three-stages or triangular species succession pattern, corresponding to the three seasons, namely post-, pre- and southwest monsoon. Each site exhibited a different pattern of species succession and composition. A total of 58 species were recorded among which 18 were new to the local fauna. Dominant species that controlled the orientation of this succession were Polychaetes (*Prionospio pinnata, Clymene annandalei, Nereis capensis*), Bivalves (*Meretrix casta, Cardium flavum*), Amphipoda (*Urothoe platydactyla*), Echiurida (*Thalassema* sp.) and Nematoda at different sites. Species succession was mainly influenced by the southwest monsoon and the local biotic and abiotic factors at specific sites.

Current Science
85(10): 1458-1474 (2003)

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Geographical information system and remote sensing for monitoring the environment

An overview of the possibilities offered when applying Geographical Information Systems (GIS) and Remote Sensing (RS) to environmental monitoring is given, based on examples taken from an ongoing project entitled 'Assessment of mangrove degradation and resilience in the Indian subcontinent: the cases of Godavari estuary and southwest Sri Lanka'. The capabilities of GIS (i) to integrate and manage huge amounts of multi-source data, (ii) to perform spatial analysis and, (iii) to produce synthetic results that can prove useful in decision-making, are highlighted. RS, as a special type of spatial information used in GIS, (iv) allows land cover mapping and the inventory of natural resources, (v) provides quantitative estimations of biophysical properties of land surface features and, (vi) is useful in tracking landscape changes over time. The examples show that synthetic information and results, such as land cover maps at different dates, aerial estimates of mangrove extension or regression, and surfaces of aquaculture converted from mangroves, paddies or bare lands, can be obtained by analyzing data from different sources in the GIS. Decision-making can make use of such results, but should further benefit from the development of spatial modelling in GIS for the simulation of scenarios. Monitoring capabilities are also improving due to the increase in spatial and spectral resolution of the recently launched remote sensors.

Tropical Ecology
44(1): 113-119 (2003)

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MANGROVE BIOLOGY

Why are mangroves degrading?

A comparison has been made among 5 luxuriant and 25 degrading sampling sites in Pichavaram mangrove forests, Tamil Nadu, India, for physico-chemical and biological variables. The data reveal that the causes of natural degradation of mangroves are mainly due to high salinity, low level of available nutrients, and poor microbial counts in the soil substrates.

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83(10): 1246-1249 (2002)

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Human mangrove conflicts: the way out

Mangrove resources are available in approximately 117 countries, covering an area of 190,000 to 240,000 km^2. Countries like Indonesia, Nigeria and Australia have the largest mangrove areas. These ecosystems harbour 193 plant species, 397 fishes, 259 crabs, 256 molluscs, 450 insects and more than 250 other associated species. Mangrove ecosystem has the highest level of productivity among natural ecosystems, and performs several ecosystem services. The continued exploitation of mangroves worldwide has led to habitat loss, changes in species composition, loss of biodiversity and shifts in dominance and survival ability. Worldwide, about half of the mangroves have been destroyed. The Indian mangrove biodiversity is rather high. The increase in the biotic pressure on mangroves in India has been mainly due to land use changes and on account of multiple uses such as for fodder, fuel wood, fibre, timber, alcohol, paper, charcoal and medicine. Along the west coast alone, almost 40% of the mangrove area has been converted to agriculture and urban development. Our understanding of the natural processes in this vulnerable and fragile ecosystem is far from adequate. Environmental awareness, proper management plan and greater thrust on ecological research on mangrove ecosystems may help save and restore these unique ecosystems.

Current Science
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Richness and diversity of filamentous fungi on woody litter of mangroves along the west coast of India

Randomly sampled decaying mangrove woody litter from ten mangroves along the west coast of India was assessed for the assemblage, species richness and diversity of filamentous fungi. Among 1067 wood samples screened, 94% of samples consisted of sporulating fungi. A total of 78 species belonging to 45 genera comprising 46 ascomycetes, one basidiomycete and 31 deuteromycetes were recovered. *Halocyphina villosa, Lignincola laevis, Lulworthia grandispora, Periconia prolifica, Savoryella paucispora, Verruculina enalia* and *Zalerion maritimum* were very frequent (> 10%). Except *H. villosa*, the rest of the fungi were common to all the mangrove locations. The mean number of fungi per wood was 2.1 (range, 1.7-2.5), which is similar or higher than those at several mangroves of the Indian Ocean. Simpson and Shannon indices were highest for the mangroves of Honnavar (Karnataka) and Panaji (Goa) (0.971 and 5.087), which coincided with the highest expected number of species (31-32) among 140 random isolations in these mangroves. Fungal assemblage, richness and diversity of the current study have been compared with other mangroves of the Indian coast and the Indian Ocean.

Current Science
83(12): 1573-1580 (2002)

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Studies on pigments, proteins and photosynthetic rates in some mangroves and mangrove associates from Bhitarkanika; Orissa

Pigment contents, proteins and net photosynthesis were investigated in fully developed leaf of 1-year-old seedlings of six mangroves (*Bruguiera gymnorrhiza, Rhizophora apiculata*) and mangrove associates (*Caesalpinia bonduc, Cerbera manghas, Derris heterophylla, Thespesia populnea*), collected from Bhitarkanika, located on the east coast of India. Large variations in the photosynthetic rates (PN) among the six species were observed, ranging from 10.16µ mol $CO_2/m^2/s$ in *C. bonduc* to 15.28 µ mol $CO_2/m^2/s$ in *R. apiculata*. The total leaf protein content ranged from 12.09 mg/g dry wt in *T. populnea* to 51.89 mg/g dry wt in *B. gymnorrhiza*. The chlorophyll a/b ratio was typically about 3.0 in all the studied species, except *C. bonduc* (2.8). Photosynthetic rates and chlorophyll a/b ratio in the leaves were found to be correlated. Analysis of chlorophyll and xanthophyll spectra suggested: (1) variations in different forms and amounts of carotenes as well as xanthophylls and (2) the presence of high amounts of near-UV- absorbing substances in leaves, particularly in the two mangroves (*B. gymnorrhiza, R. apiculata*) and a mangrove associate (*T. populnea*), which appears to be an adaptive feature. Estimation of the chlorophyll a/b ratios in isolated thylakoids yielded a low value of 1.8 for *R. apiculata* and > 2.6 for other species. The total protein /chlorophyll ratios in thylakoids varied considerably from 3.14 (*D. heterophylla*) to 10.88 (*T. populnea*) among the mangrove associates and from 16.09 to 18.88 between the members of the Rhizophoraceae. The chlorophyll/carotenoid ratios in thylakoids of the six species were more or less similar. The absorption spectra for washed thylakoids of *C. manghas* and *D. heterophylla* exhibited absorption characteristics typical for C_3 plant thylakoids. However, thylakoids isolated from *R. apiculata, B. gymnorrhiza, C. bonduc* and *T. populnea* exhibited an unusual increase in absorption in the blue region (380-410 nm) of the absorption spectrum. The presence of high-absorbing (in the short-wavelength, near-UV region) pigments appears to be closely associated with the thylakoids in *R. apiculata* and *T. populnea*. Our results, therefore, suggest a wide range of variation, not only in protein and pigment contents of photosynthetic tissues, but also in the spectral characteristics and composition of the pigments in mangrove species. An understanding of the nature of these pigments in mangroves and their associates, under their natural conditions and especially in relation to eco-physiological adaptations, is necessary, not only in relation to conservation, but also to allow propagation under different salinity conditions.

Marine Biology
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Molecular phylogeny of mangroves VIII: analysis of mitochondrial DNA variation for species identification and relationships in Indian mangrove Rhizophoraceae

Ten species belonging to four genera of the mangrove tribe Rhizophoreae found in the Indian subcontinent were analysed for species identification and genetic relationship using nine mitochondrial gene probes. RFLP pattern observed with 27 probe enzyme combinations in the genera *Rhizophora, Bruguiera, Ceriops* and *Kandelia* differentiated the species into three classes of mitotypes with further resolution within them. Clustering of these mitotypes indicated that *Rhizophora* was more closely related to *Ceriops-Kandelia* than to the *Bruguiera*. Though the component species of each genus clustered together, a high degree of heterogeneity was observed among four species of the genus *Rhizophora* and three species of genus *Bruguiera*. The variation between two species of *Ceriops* was minimal. Species-specific profiles were observed for all the species in some probe-enzyme combination. Though the monotypic genus *Kandelia* shared a number of loci with genus *Ceriops*, it remained distinct. The putative parents of the naturally occuring interspecific hybrid in Pichavaram were reconfirmed to be *R. apiculata* and *R. mucronata*. The results are discussed with regard to the taxonomic and phylogenetic relationships between different species and genera of the tribe Rhizophoreae.

Wetlands Ecology and Management
10(5): 355-362 (2002)

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Incidence of marine and mangrove bacteria accumulating polyhydroxyalkanoates on the mid-west coast of India

The tropical marine and mangrove microflora from the mid-west coast of India were found to be diverse with respect to enzymatic activities. The bacterial counts and the enzyme activities of the mangrove microflora were found to be influenced by the seasonal variations. The microflora of these ecosystems also possessed a high potential to accumulate important polymers such as polyhydroxyalkanoates (PHA). Out of a total of 866 bacterial cultures isolated from this region, 337 cultures were scored positive for PHA production. Amongst these isolates, seven cultures accumulated more than 1 g of PHA per litre of culture broth. The TLC profiles of the methyl esters of PHA from the seven cultures showed varied profiles. The sediment samples also showed the presence of PHA with five different monomeric units.

World Journal of Microbiology and Biotechnology
18(7): 655-659 (2002)

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Impact of Sundarban mangrove biosphere on the carbon dioxide and methane mixing ratios at the NE Coast of Bay of Bengal, India

Diurnal and seasonal variations in carbon dioxide and methane fluxes between Sundarban biosphere and atmosphere were measured using micrometeorological method during 1998-2000. Study of the diurnal variation of micrometeorological conditions in the atmosphere was found to be necessary to

determine the duration of neutral stability when flux estimation was reliable. Neutral stability of the atmosphere occurred in the limited micrometeorological conditions, when friction velocity ranged between 0.360 and 0.383 m s^{-1}. The value of drag coefficient (1.62-20.6) x 10^3 obtained at variable wind speed could be deemed specific for this particular surface. 58.2% drop of carbon dioxide and 63.4% drop of methane in the atmosphere at 1 m height were observed during day time, between dawn and early evening. Diurnal variations in methane and carbon dioxide mixing ratios showed a positive correlation with Richardson's number (Ri). This environment acted as a net source for carbon dioxide and methane. The mixing ratios of methane were found to vary between 1.42 and 2.07 ppmv, and that of carbon dioxide, between 324.3 and 528.7 ppmv during the study period. The biosphere-atmosphere flux of carbon dioxide ranged between -3.29 and 34.4 mg m^{-2} s^{-1}, and that of methane, between -4.53 and 8.88 µg m^{-2} s^{-1}. The overall annual estimate of carbon dioxide and methane fluxes from this ecosystem to atmosphere was estimated to be 694 Tg yr^{-1} and 184 Gg yr^{-1}, respectively. Considerable variations in mixing ratios of carbon dioxide and methane at the NE coast of Bay of Bengal were observed due to the seasonal variations of their fluxes from the biosphere to the atmosphere. The composition was inferred by fitting model prediction to measurements.

Atmospheric Environment
36(4): 629-638 (2002)

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Towards improved environmental and social management of Indian shrimp farming

In the last decade, Indian shrimp aquaculture production tripled from 30,000 tons (1990) to 102,000 tons (1999). This fast development, combined with a lack of adequate planning and regulation, caused a number of environmental problems and social conflicts, including conversion of mangroves, water pollution, and salinization of drinking water wells. Because of the significant investments made in shrimp culture and the size of the environmental and social impacts, the formulation of a regulatory framework for shrimp aquaculture has been subject to an intensive debate between the aquaculture and the environmental lobbies. Following an order from the Supreme Court (1996), the Aquaculture Authority was established and a regulatory and institutional framework for the shrimp aquaculture sector has been set up. However, implementation of the system is still defective, and there is an urgent need for improvement. Farmers are increasingly able to prevent the devastating white spot disease in shrimps, and in the absence of proper planning and regulation, further expansion of shrimp production could result in significant additional environmental and social costs. The environmental and social management of Indian shrimp farming can be improved through a mix of policy measures, including strengthening of the license system, more effective enforcement of regulations, the use of economic incentives, and increased monitoring of environmental and social impacts.

Environmental Management
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CORAL REEF BIOLOGY

Horiolide, a novel norditerpenoid from Indian ocean soft Coral of the Genus *Sinularia*

A novel norditerpenoid, horiolide (1), has been isolated from an Indian Ocean soft coral of the genus *Sinularia*. The structural elucidation was achieved by a study of its spectral characteristics. This compound is structurally characterized by a new carbon skeleton having one six-membered cyclohexane ring bearing an isopropylene moiety, a carbonyl group, and one seven-membered ring attached to a five-membered lactone moiety.

Journal of Natural Products
65(5): 737-739 (2002)

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Radiocarbon dates of corals, gastropods and foraminifers from Saurashtra Peninsula, Gujarat and their implications for sea level studies

High precision Acceleration Mass Spectrometry (AMS) dates of corals, gastropods and smaller foraminifers from a coral-algal stratigraphical sequence, exposed 2.73-4.20 m above the present MSL, near Mithapur on Dwarka-Okha coast, have been reported in the present paper. The age ranges from ca. 41.2 to 18.3 ka BP. The mineralogy, petrology and $\delta^{13}C$ values of the samples indicate that the dates are reliable within the limitations of the dating method. Confirmatory U/Th dating will, however, be useful to strengthen the conclusion. Since the samples are from the intraplate area of the Saurashtra Peninsula, the present position of 41.2 and 18.3 ka old sea level recorders cannot be explained by a large-scale uplift. At the same time, they cannot be taken as the records of the sea level stands of similar to 40 ka and similar to 18 ka BP, as the generally accepted data suggest very low sea level stands of the periods. Therefore, an epeirogenetic model is to be evolved that satisfactorily superposed younger similar to 18 ka sediments, but also the corals of 118 - 176 ka BP ages that co-exist at low altitudes at Mithapur.

Journal of the Geological Society of India
60(3): 303-308 (2002)

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LAGOONAL BIOLOGY

Comparative account of physico-chemical parameters, enzymatic activity and plankton population in three water bodies of Mysore city

A comparative account of physico-chemical parameters, plankton population and enzymatic activity in a freshwater lake receiving sewage, and a sewage oxidation pond was prepared. Statistical DMRT test was applied to the data to arrive at precise conclusions. Only 10 out of 22 parameters showed significance. Kukkarahalli lake was the most sensitive water body as compared to Dalvoi lake and sewage oxidation pond. It responded to water temperature, pH, phosphate, ammonia and the enzyme phosphatase activity. The lake supports a permanent bloom of *Microcystis aeruginosa* and is subjected to rapid changes in environmental conditions. It is fast turning into a sewage lagoon.

Nature, Environment and Pollution Technology
1(2): 165-169 (2002)

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UPCOMING RESEARCH MEETS

- April 2 - 3, 2005. International Coral Reefs Conferences of Paris (CIRCoP): Location : Paria, French Republic. Contact: Fabrice Poiraud - Lambert. Web Link : http://www.icriforum.org/util/ext_disp.cfm?Uval=www.circop.com

- July 3 – 7, 2005. Waves 2005: The Fifth International Symposium on Ocean Wave Measurement and Analysis. Contact: Tilesa Opc, S.L., Londres, 17, 28028 Madrid, Spain. Phone :. +34 91 361 2600; Fax +34 91 355 9208; Email: waves2005@tilesa.es

- August 29 - September 3, 2005. 4th Western Indian Ocean Marine Science Association Scientific Symposium. Location : Grand Baie, Mauritius. Contact : The Executive Secretary,. Web Link: http://www.icriforum. org/util/ext_disp.cfm?Uval=http:/www.wiomsa.org.

- September 19-23, 2005. Dunes & Estuaries 2005: International conference on Nature restoration practices in European coastal habitats. Contact: Jan Seys (VLIZ, Belgium), Conference Secretariate. E-mail: de2005@vliz.be.

- October 2 - 5, 2005. 8th International Conference on Shellfish Restoration: Enhancement and sustainability of shellfish resources. Contact: Jeanne Moal or Philippe Soudant, France. E-mail: icsr05@ifremer.fr

- October 23 - 26, 2005. Trends in Medical Mycology. Contact: Congress Secretariat, Congress Care, Huntelbolwerk 1, P.O. Box 440, 5201 AK 'S-Hertogenbosch, The Netherlands. Phone: +32 - 73 683 1238; Fax: +31 - 43 690 1417; E-mail: info@congresscare.com; Website: www.congresscare.com.

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