Abs Nr. OR-003

Gorgonians as an Indicator of Metal Pollution

P. Velayutham[1], G. Sanjeeviraj[1] and V. Ramadhas[1]

Aquatic animals have been widely used as indicators of metal pollution in many aquatic ecosystem (Philips, 1977 and 1980). However, there is brevity of information on the potential effects of heavy metals on coral reef ecosystem, which is particularly vulnerable to pollution (Howard and Brown, 1984). The potential pathway by which heavy metals can be incorporated into corals have been described by Howard and Brown, 1987). There is evidence to suggest that coelenterates are able to effectively regulate or even exclude heavy metals (Brown and Howard, 1985). Harland and Brown (1989) studied the uptake of iron by coral tissues and its effects were investigated in the scleractinian coral, *Porites lutea.* In the present study concentrations of heavy metals such as copper, zinc, manganese, chromium and lead were studied during 1992 in *E.indica* and *G.umbraculum* collected from Thoothukkudi and Rameswaram coastal waters. Summer and monsoon seasons were chosen for conducting the investigations since these two seasons were contrasting with respect to change in water quality. In both the species high accumulation of all metals could be recorded during summer season than monsoon season. *G.umbraculum* and *E.indica* showed increment in the concentration of heavy metals with increase in size. Among the five metals investigated the highest concentration of lead and the lowest concentration of copper were recorded in both the species and centers during the two seasons. The results are discussed in the paper.

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Abs Nr. OR-004

Chemical Species of Sedimentary Phosphorus in Tuticorin Coastal Water Ecosystems

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The present investigation was carried out in four stations. (Pullavazhi brackish water, Tuticorin Mangrove, Sewage polluted fishing harbour area, and the near shore water). In these four stations four different fractions of sedimentary phosphorus (exchangeable sedimentary (E-P), sedimentary phosphorus bound to carbonate (CO_3-P), phosphorus bound to oxides of Iron and Manganese (O-Fe & Mn-P), phosphorus bound to sedimentary organic phosphorus (P-O), phosphorus bound to Iron and Aluminium (Fe-Al-P), Apatite phosphorus (A-P) and Residual Phosphorus (R-P) were investigated for a period of one year. Among the four different chemical species of Sedimentary Phosphorus apatite phosphorus appeared as the major contributor to total Sedimentary Phosphorus and P-O ranked to it. Fe and Al-P appeared as the third / fourth major contributor. Mostly exchangeable phosphorus contributed to the lowest percentage of Total Sedimentary Phosphorus. The study affirmed that ever under the phosphate limiting conditions, biological fertility of the coastal water was mostly decided by the supply of phosphate from the sedimentary organic phosphorus and phosphate bound to Fe & Al. Based on the chemical speciation of Sedimentary Phosphorus, stations are compared with respect to their magnitude of supply of phosphorus to the coastal water.

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Abs Nr.OR-007

An Integrated Study on Metal Reducing Bacteria in Pulicat Lake and Ennore Creek

S. Kamala Kannan[1], S. Mahadevan[2] and R. Krishnamoorthy[1]

The use and dispersion of heavy metals has increased vastly during the 20th century and the behavior of metals in the aquatic environment is therefore a matter of rising concern. Metals like all elements, are not biodegradable and it can be transformed from one chemical state to another state, as a result becomes most toxic eg. methyl mercury. Hence the reduction/oxidation of heavy metals by microorganisms especially by bacteria plays an important role in reducing their level in aquatic environment.

Among the heavy metals mercury (Hg) is one of the most toxic element. After discharge into the aquatic environment mercury enters into the sediments where it persists for many decades before it enters the food chain in the form of methyl mercury. Subsequently, the methyl mercury is biomagnified in the food chain. In the predators it binds to the sulfhydryl group of proteins and enzymes, thereby inactivating cellular functions. Hence, the present study was focused on the mercury-reducing bacteria present in Pulicat Lake and Ennore Creek located to the north of Chennai City. Nearly 14 different bacterial species were isolated from the sediment samples. Most of the isolates exhibited resistance against organic mercuric compounds ranging from 20 mg/ml to 40mg/ml and also resistance to inorganic mercuric compounds ranging from 200 microgram/ml to 650mg/ml. In addition to mercury, resistance to various heavy metals like Chromium, Nickel, Lead, Cadmium and Zinc was also observed. These isolates also showed increased antibiotic resistance. Growth of the isolated bacteria at various salt concentrations (5% to 25%) and the pH range (5 to 10) was monitored. The growth kinetics of the organisms in the presence of mercury was also determined. The results of these studies will be discussed.

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Species Diversity and Seasonal Variations of Gorgonians collected from Gulf of Mannar Coastal Waters

G. Sanjeeviraj[1] and P. Velayutham[2]

Coral reefs are diverse, intricate and vulnerable marine ecosystems characterized by a complex interdependence of plants and animals. They are, therefore, exceptionally productive and a valuable natural asset. Anthozoans built by living organisms include sea fans, corals, sea anemones, etc. are exclusively marine cnidaria. The major octocoral representatives are the gorgonacea including the sea fans and sea whips, which are highly flexible, often branched sessile epifauna. Gorgonoids exported from India are commercially grouped under four types: Black, Red, Flower and Monkey Tail. Species wise distribution and abundance of gorgonians were investigated in the three landing centres of south Tamil Nadu viz. Rameshwaram, Thoothukudi and Kanyakumari in the Gulf of Mannar (GOM) region during 1991-'92 and 1992-'93. Among the four different types of commercially important gorgonians, the red type contributed to the highest value of annual percentage contribution (36.70%), followed by black (32.53%) during 1991-'92 at Rameshwaram. The total landings of all commercially important gorgonians were; at Rameshwaram 2,378 kg; Thoothukudi 2,588 kg and Kanyakumari 1,725 kg. Among the four types, the red type contributed to the maximum percentage of total landings followed by red, monkey tail and flower types during 1991-'92 and 1992-'93. The results have been presented and discussed in the paper.

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Coastal Ecosystem Interactions – a Case Study of Flora at Narara Island in the Marine National Park of India

A.J. Joshi[1] and S.S. Khot[2]

Marine National Park of India comprises of an intricate network of 42 islands, 20 of which support mangrove and halophytic vegetation. Narara ($22^0$27' N, $69^0$43' E) is one of the smallest islands having only 4 halophytic species namely, *Avicennia marina*, Vieh., *Halopyrum mucronatum*, Stapf., *Haloxylon salicornicum*, Bunge ex Boiss and *Suaeda fruticosa*, Forsk, was selected for study. Out of the 4 species, a mangrove *A. marina* and a grass *H. mucronatum* belong to salt excreting group, whereas *H. salicornicum* and *S. fruticosa* have succulent phylloclades and leaves, respectively. The impact of spatial and temporal variations on accumulation of osmoregulatory solutes in the said morphologically different species has been worked out.

Soil samples and plant material was collected twice during monsoon, winter and summer in the year 2000-2001. Electrical conductivity and pH of sandy soils (1:2 extracts) supporting these plant communities varied between 0.41 to 17.05 dS. m^{-1} and 7.3 to 8.18. The study indicated that EC, pH, Na^+, Cl^-, Ca^{2+} and Mg^{2+} of soils collected from four locations and during monsoon, winter and summer were statistically significant ($p \leq 0.01$). Thus, the plant species grew in different edaphic conditions on the same island.

On the other hand, free amino acids viz., γ-amino butyric acid, alanine, aspartic acid, asparagine, phenylalanine and proline accumulated in high concentration in vegetative organs of all the species. It was observed that the plants significantly differed ($p \leq 0.05$) in accumulating alanine, aspartic acid, phenylalanine and proline. Furthermore, accumulation of γ-amino butyric acid, alanine and proline significantly fluctuated ($p \leq 0.01$) during monsoon, winter and summer.

Concentration of total and reducing sugars varied from 10.1 to 66.04 $mg.g^{-1}$ and 7.17 to 30.58 $mg.g^{-1}$ d. wt. and 2-way ANOVA suggested that the species differed significantly ($p \leq 0.01$) in accumulating these sugars. Impact of different seasons on quantities of the sugars was also significant ($p \leq 0.05$). Furthermore, accumulation of major ions Na^+ and Cl^- in vegetative organs of different species was statistically ($p \leq 0.01$) different and amounts of Cl^-, Ca^{2+} and Mg^{2+} were affected by seasonal changes ($p \leq 0.01$). The study clearly indicated that spatial and temporal changes on the same island had significant impact on accumulation of osmo-regulatory compounds and inorganic mineral ions in 4 morphologically different halophytic species.

Findings on electrical conductivity, pH (1:2 soil extracts), ionic composition of saline habitats and data on accumulation of free amino acids, sugars and mineral ions in 48 plant samples will be presented.

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Abs Nr. OR-012

Role of DGPS in Oceanographic Survey - Case Study

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Integrated field investigations basically involve collecting data on the tidal currents, thermal mapping etc., over the area of the water body. The equipments used for conducting data collection mainly include a survey boat, precision current meters, thermal probes and boat position fixing system. The field investigations will be effective, when the position of the boat is fixed accurately. Conventional procedures involved for position fixing such as nautical sextant, manual methods encounter inaccuracies due to limitations of equipment and manual errors.

During the last couple of years, Global Positioning System (GPS) based solutions have become viable and economical. With this method, it is possible to fix the location with an accuracy of few meters. Single GPS will not serve the purpose of referencing, as there is likelihood of major error to the tune of 8 to 10 meters. Besides if the coordinates, obtained by GPS is converted between different Geo-references (i.e Everest to WGS-84), the error becomes cumulative. Differential GPS (DGPS) will, on the other hand, provide the requisite coordinates of the small features more accurately. It is a prudent policy to have a mesh of DGPS points in the area of interest. These points will be useful for geo-referencing as well as for the subsequent surveys. DGPS incorporates a reference station, whose position is fixed. During the time of data collection, the fixed receiver transmits the correction signal through a radio link to the moving receiver and allows the computation of the position of the moving unit accurately. The difficulty involved in fixing the reference station is overcome, if the GPS unit incorporates a beacon station receiver. The Beacon signals (Radio wave) are available along the shorelines free of cost.

This paper deals with the DGPS based data collection work, carried out by CWPRS along a project site near Chennai, TamilNadu during April-May 2002, in order to measure the thermal characteristics as well as the tidal parameters in selected region of the project. CEEDUCER make GPS system along with DIGILINK make thermal probes and water current meters (Valeport and RCM - 7 models) were utilized in carrying out this work. Correction signal are received from the nearest radar-beacon station. This methodology helps to have a position fixing accuracy of the order of one meter. The data collected on various parameters are downloaded from the GPS system to the Laptop using the data logger software provided with the instrument. Further analysis on the data is

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carried out using Excel and SURFER software packages. Use of the techniques discussed above is highlighted in the paper. The results of the thermal mapping, tidal currents prevailing at site are presented for illustration.

Abs Nr. OR-022

Reproductive Characteristics of a Silver Biddy, *Gerres abbreviatus* as Implications for the Southeast Fishery of India

K. Sivashanthini[1] and S. Ajmalkhan[1]

Coastal marine fishery is an economically important resource, which provides high quality protein food for human consumption. Obviously, vast increases in total investments on crafts and gears to increase fishery exacerbates sustainable fishery. Therefore, management measures of fish stocks for the benefit of present and future generations without harming the ecosystem's capacity to support human life have become ever more urgent. Gerreids, members of the Teleostean family Gerreidae of the order Perciformes are small to medium sized fishes and valued as delicious food fishes. These are popularly called as 'Mojarras' or Silver-biddies and contribute an important component of the coastal fishery of India. These are sold predominantly as fresh fish in the markets. Distributed widely in the Indo-pacific region, these fishes support considerable fisheries in many countries such as Bahrain, Fiji islands, Kiribati, Malaysia, Mexico, Philippines, Qatar, Saudi Arabia, United Arab Emirates and United States of America. FAO annual catch data shows that world catch of gerreids increased dramatically from 1980 to 1990 (4750 metric tons to 12,832 metric tons). But it dropped during 1990-1998 to 8,415 metric tons. Gerreids fall well under the category of perches and the total landings of perches during 2001 in India recorded a decline of about 12,760 tones as compared to 2000. This warrants more effective research and development efforts to implement suitable action plans for sustained marine fisheries of gerreids and Mari culture development.

Recruitment through reproduction is the means by which the resource is renewed. Consequently, the present study on reproductive characteristics of *Gerres abbreviatus* is the first attempt to record some information, which will be used in stock assessment models and evaluation of harvest strategies designed to optimize reproductive capacity and recruitment of *G. abbreviatus* in southeastern Indian waters. This paper presents the results of a comprehensive study to describe gonad development and patterns in the reproductive cycles and provide reproductive parameters, including length at maturity, gonadosomatic index (GSI), annual fecundity and batch fecundity.

These results are discussed in light of the future management measures in the fishery, which will be useful on the long-term sustainability of *G. abbreviatus*.

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Abs Nr. OR-023

Destruction of Coral Skeletons by Boring Organisms (Siliceous sponges) in Gulf of Mannar, India

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In Gulf of Mannar there are about 20 species of coral boring sponges. Generally the bioeroders weaken the coral species and distroy the structure. They are the producer of carbonate sediments by eroding and converting the massive coral structure into coral fragments and coral silt. An attempt is made to study the different types and pattern of bioeroders, which weaken the corals of Gulf of Mannar. Selected species of coral skeletons were collected for the detailed study of internal morphostructures, as well as the macro and micro eroders. It has been estimated that micro boring range from 1mm to 9 mm and macro boring ranges from 4mm to 2 cm depth and penetration ranges up to a depth of 4mm to 3cm. The major boring organism in Gulf of Mannar is siliceous sponges. The reef destruction in this study area is larger than the damages caused by storms, surges etc. The destruction due to boring organisms can be reduced by using mooring buoys, navigation boundary, controlling over fishing and by banning of coral collection. Moreover reef transplanting can be encouraged to stabilize the reef substrate and to rebuild reef topography.

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Abs Nr. OR-024

Spatio-temporal Variations of Water Quality in Pulicat Lake Estuary

P. Elayaraja[1] and R. Ramanibai

The physico-chemical analysis of the estuarine waters of Pulicat Lake (Lat. 13°26' and 13°43'N and Long. 80°03' and 80°18'E) was carried from July-2002 to June-2003. Three sampling sites were selected; one at the mouth of the estuary and the other two locations were selected 2 and 4 km away from the mouth region. Temperature, pH, salinity, dissolved oxygen (DO) and chlorophyll a (chl a) showed a marked spatio-temporal variation. Salinity and DO were particularly high at the mouth region, whereas the pH was highly alkaline in stations away from the mouth. The surface water temperature varied significantly when compared with the bottom water temperature. The temperature seemed to influence the productivity, which was measured in terms of chl a concentration. Nutrients such as phosphate, nitrate, nitrite and silicate also varied spatio-temporally. The silicate concentration depended upon the diatom flora of the estuary and vice-versa.

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Abs Nr. OR-026

Model Studies for Improvements to Fishing Operations in Periathalai Village in Tuticorin District

P.K. Suresh[1], A. Selvarajah[1], M. Jayapalan[1] and K. Veluchamy[1]

Tamil Nadu has a coastline of 906.8 km bordering east and west coast and exhibiting various features along the coast. Periathalai is a coastal village in Tuticorin District lying north of Tiruchendur near Kanniyakumari facing Bay of Bengal. Fishing is the main activity for the people of this village and there are about 4000 families engaged in fishing using conventional catamarans. About 1 km from the shoreline submerged coral rocks are present for a length of 2.5 km with discontinuity. The presence of these rocks result in heavy wave break, which causes lot of hardship to fishing operation. The problem is severe during southwest monsoon. Another important aspect to be mentioned is that only during this season costly prawns are available. Because of the above mentioned problem, fishermen are finding it difficult to fish and hence it results in heavy economic loss. So this problem was referred to this Institute of Hydraulics and Hydrology, Poondi. The details of the studies conducted and recommendations suggested to improve the fishing facilities are presented.

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Abs Nr. OR-030

Occurrence and Seasonal Variation of Faecal Indicator Bacteria in Beach Sand and Coastal Waters of Thoothukkudi

G. Sugumar[1], B. Christolite[1] and P. Velayutham[1]

The beach sand and water samples at four fish landing sites of Thoothukkudi were analysed for faecal indicator bacteria from July 2002 to June 2003. The fish landing sites included Thirespuram fish landing centre, fishing harbour, south landing centre and port trust beach landing centre. Counts of total coliform bacteria, faecal coliform bacteria and *E.coli* were estimated by 3-tube most probable number (MPN) method, while faecal streptococci were enumerated by pour plate technique. Water and sand samples collected at the Thirespuram fish landing centre were heavily loaded with total and faecal coliform bacteria all through the year, while *E.Coli* counts showed fluctuations, with least values recorded during January 2003. Faecal streptococci counts were also heavily contaminated with faecal indicator bacteria. *E. coli* showed fluctuations ranging from MPN <1 to 450 / ml with least counts observed during December-January. Water and sediment samples from Tuticorin fishing harbour harboured low levels of *E.coli* and faecal streptococci. Even the coliform bacterial counts showed seasonal variations, which could be related to human activity in the fishing harbour. During closed seasons and non-fishing months, the counts were low. Samples from port beach landing sites were generally clean with low numbers of faecal indicator bacteria recorded during most part of the year. Poor hygienic conditions, letting in of untreated domestic sewage, poor awareness among the fisherfolk and lack of proper infrastructure facilities and potable quality water supply at the landing centres were the reasons attributed to the poor microbiological status and faecal pollution at the fish landing centres of Thoothukkudi.

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Abs Nr. OR-033

Distribution of Trace Elements in the Sediments of Nearshore Environment, Tuticorin, Tamil Nadu

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Tuticorin is a port town, clustering with major industries. Most of the industrial wastes are mixing with nearshore environment through different kinds of outlets. This information made a curiosity to understand the elemental distribution in the sediment and leads to this study which had been undertaken around Lat. 8o 35' 12" and 8o 40' 10" N and Long. 78°03'09" and 78°10'26" E. Twenty five sediment samples were collected using stainless steel VanVeen grab in the environments of the estuary, tidal channel and nearshore. The sediment samples were analysed using standard methods such as Organic carbon, carbonate, Ca & Mg were estimated by titrimetric method, Na, K & Li by flame photometer and Sr, Cu, Ni, Ba, V, Pb, Co, Mn, Cr, Fe & Mn by Atomic Absorption Spectrophotometer.

The organic carbon (0.24 to 2.10 %) and carbonate (1 to 52 %) suggest that the influence of plant debris, organic waste from inland, oil waste, broken shells fragment from buried sediments and dead shells. The distribution of Na and K suggest to have much association with the saltpan and mineral matters and also indicate that river discharge provide the Na and K rich minerals in to the nearshore sediments. Ca and Mg show no systematic distribution. Fe (0.5 to 6 %) and Mn (0.005 to 0.108 %) suggest detrital component have influenced these elements to the sediments i.e. especially detrital minerals along with dumps of boat yards and jetties situated around the study area. Sr (ND to 3000 ppm) and Cu (5 to 68 ppm) suggest the biogenic relationship of these two elements along with that the Sr distribution also influenced the saltpans present in this vicinity. Ni (ND to 6137 ppm), V (ND-791 ppm) and Pb (43 to 919 ppm) represent the influence of solid and liquid wastes of boat yards, fishing harbor and fish processing industrial waste along with oil pollutants. The element Co (501 to 4770 ppm) and Cr (ND – 1660 ppm) distribution assigned to the influence of titanium complex, heavy water plant, SPIC, TAC and Thermal Power Plant wastes along with the presence of seaweed and algal debris. These data subjected to the R Mode factor analysis and the results suggested that five factors play a major role for enrichment and distribution these elements. They are saltpan influence, shell source, plant debris, lithogenic sediments and waste discharge from the surrounding industries.

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Abs Nr. OR-035

Characterization of Coastal Waterways near Marakkanam, Tamil Nadu, India

S. Selvaraj[1] and R. Baskaran[1]

The ever-increasing population exerts a pressure on the use of land in the coastal regions. This is a national and even international phenomenon, which call for the attention of scientists of varied disciplines, planners and policy makers. Landform studies are an aspect, which throws light on the scopes of using the land for varied purposes. The coastal region of Tamil Nadu has several geomorphic features detailed study of which would be of use in their effective utilization. The present day coastal land use practices are mostly unscientific and unplanned the net effect is that they are either misuse or over exploitated. The estuaries and the associated lagoons present near Marakkanam in Tamil Nadu have prospects of wide range of benefits that could be sustainably exploited. The scientific management and exploitation of this ecosystem demands a detailed knowledge of their physical characters, geology and geomorphology. This paper makes an attempt on such characterization of the lagoons, which would serve as an important database for the managers, planners, and local people who may have interests in finding the proper uses.

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Abs Nr. OR-036

Coastal Zone Management in India – Critical Appraisal of Legal Control

S. Ganapathy Venkatasubramanian[1] and T.V. Lakshmanan[2]

India has a lengthy coast of over 6000 kilometers supporting numerous fishing communities and driving the economics of coastal villages, towns and cities. The continental shelf up to the depth of 600 fathoms from the coastline is the most important aquatic food source for mankind. The major classes of human interventions that threaten India's marine environment are maritime trade, the exploitation of ocean resources and on land coastal development.

The legislative frame work for control of marine pollution is provided by the Territorial waters, Continental shelf, Exclusive Economic Zone, and other Maritime Zones Act of 1976. The Act asserts India's sovereignty over the natural resources in the Continental Shelf (Section 6(3) (a)) and Exclusive Economic Zone (Section 7 (3) (A)). Section 6 (3) (d) and 7 (4) (d) confer exclusive jurisdiction on the Central Government to preserve and protect the marine environment and to prevent and control marine pollution within Continental shelf and Exclusive Economic Zone. Specific provisions under the Merchant Shipping Act (1958) govern the civil and criminal liability regimes in respect of oil spill.

Development along coastal stretches is restricted under the regime of Coastal Regulation Zone (CRZ) Notification 1991 under Environment Protection Act (1986); approved Coastal Zone Management Plan (CZMPs) for each state or regions; adhoc clarifications in respect of the main notification and CZMP issued by the Ministry of Environment and Forests, Government of India and local town and country planning laws to the extent that they do not conflict with the CRZ Regulations.

Then comes function of the Rule of the Law. Apart from the administrative justice component of the rule of law judge made law and justice balances the conflict of interest between the need and greed.

In the first part of the paper an attempt has been made to analyse critically the CRZ Regulations.

In the second part of the paper an attempt has been made how far the judge made law and justice standardized the balancing functions between "Development" and "Sustainability" as well as "economic exploitation" and overall intergeneration "equity"

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Abs Nr. OR-037

Critical Examination of Adequacy of National Laws for Wetlands in India

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India is a party to the Convention on Wetlands text, as amended in 1982 and 1987, better known as The Ramsar Convention on Wetlands.
India has shown its commitment to the implementation of the treaty by increasing the number of internationally important wetland sites. The convention is a short one having 12 Articles. The importance of the Convention lights in that, the convention specifically deals with wetlands. Further unlike other environment related Conventions, this particular convention does not merely speak about usage. The Convention does not curtail human activity and put human activity as contrary to the environment. There are guidelines and additional guidance for the implementation of the wise use concepts.
There is a clamor for elaborate legislation in the context of wetland and wise use principles. It is well to remember that the Convention speaks only about policies and institutions, even though the additional guidance for the implementation of the wise use concepts provides for the review of legal and institutional issues.
This paper attempts to analyze the existing legal framework in the context of management of wetlands and implementation of wise use concepts. The purpose of the paper is to take into account the Indian Constitution and Legal jurisprudence and examine whether they raise any need for legislation for the purpose of management of wetlands. The theme is approached in three ways:

(a) implementation of international treaty
(b) constitutional necessity for the legislation and the scope of the legislation in the context of recognized legal principles as to legislation and
(c) whether there is any requirement in the convention itself for legislation.

The first section deals with the ranging question whether international law will become a part of municipal law automatically, in the context of development in the Indian judicial thinking.
The second section takes into account the Constitutional provisions as well as jurisprudential aspects of legislation. According to the Constitution the executive power of the State is co-extensive with that of the legislative power. Therefore once power is available either to the State Government or the Central Government there is no necessity for a specific legislation. Further, the legislative exercise involves laying down general principles, on the other hand wetland management requires specific approach to particular wetland. Therefore, there is no necessity for legislative framework.

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The Convention is basically research oriented, and encouraging mutual co-operation, apart from setting guidelines for implementation of wise use concepts. In fact, certain provisions of the guidelines on management planning for Ramsar sites and other wetlands, first adopted as an annex to Resolution 5.7, in the 5th Meeting of the Conference of the Contracting Parties, Kushiro, Japan, in June 1993 taking into account the fact that the management plan has to be technical and not a legal document

Abs Nr. OR-038

Biological Diversity of Godavari Mangroves – An Important Natural Resource for Conservation and Management

P.S. Rajasekar[1] and A. Suresh Babu[1]

In Andhra Pradesh the mangrove ecosystems are located at Godavari and Krishna River estuaries spread over an area of 420 sq.km are characterised by tropical wet-evergreen forests. The Godavari (Coringa) mangroves are rich in their biological diversity after Sunderbans of West Bengal and Bitherkanika mangroves of Orissa in East coast of India. The mangrove trees, shrubs and creepers not only characterize the ecosystem but also define an important living source to the local people which has been widely used from centuries together.

Being an important natural resource and due to their fragile nature these mangrove forests have been cited in the directory of Asian wetlands by the International Union for the conservation of Nature and Natural resources (IUCN) at Ramsar convention, 1989 for their protection and conservation from all possible threats.

These mangrove forests are now become prime targets of exploitation in recent years for intensive shrimp farming practices and for other major developmental activities. These anthropogenic activities have resulted in denudation of mangrove vegetation and threatening the mangrove biodiversity which affects on reduction of fish landings, loss in diversity of fish catches from artisinary fishing and inadequate supplies of raw materials for traditional use.

For the conservation of these natural resources, management plans have been formulated for sustainable use and long-term protection in the interests of local people.

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Abs Nr. OR-039

Use of the Duckweed Species *Spirodela polyrhiza* for Nutrients Recycling from Domestic Wastewater and Fish Feed

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The paper presents the performance of duckweed species *Spirodela polyrhiza* for nutrient recycling from domestic wastewater. The nutrient recycling process completes in two steps, (a) *Spirodela polyrhiza* uptake nutrient from domestic wastewater, and (b) use of *Spirodela polyrhiza* as carp fish feed. For this study a series of experiments was conducted on the cultivation of *Spirodela polyrhiza* in a domestic wastewater treatment plant. From this study it was observed that *Spirodela polyrhiza* has high productivity (up to 170-kg dry weight per hectare per day) and remarkably high protein content (up to 29% of the dry weight) in domestic wastewater culture. It tolerates and contains high amount of nitrogen and phosphorous. It is possible to remove up to 7.9kg nitrogen and 0.63kg phosphorous per hectare per day. The correlation-coefficient (r) between *Spirodela polyrhiza* production and TKN (total kjeldahl nitrogen) concentration in wastewater is 0.99 and between *Spirodela polyrhiza* production and TP (total phosphate) concentration in wastewater is also 0.99. This indicates that *Spirodela polyrhiza* production is highly related with TKN and TP concentration in water. The nitrogen and phosphorus contents in *Spirodela polyrhiza* increase significantly with an increase in nitrogen and phosphorous concentration in domestic wastewater. Unicellular algae, temperature, crowding and pH have noticeable effects on the productivity and nutrients (nitrogen and phosphorus) uptake. In this study it is found that *Spirodela polyrhiza* culture on domestic wastewater contain 18 to 29 percent protein and it vary from first bend to last bend. Duckweed protein has higher concentrations of the essential amino acids, lysine and methionine, than most plant protein and more closely resembles animal protein in that respect. Duckweed also has high concentration of trace minerals and pigments, particularly beta-carotene and xanthophyll, that make duckweed meal an especially valuable supplement for poultry and other animal feeds. That total content of carotenoids in duckweed meal is 10 times higher than that in terrestrial plants; xanthophyll concentration of over 1,000 parts per million (ppm) were documented in poultry feeding trials (Mbagwu and Adeniji, 1981). This is economically important because of the relatively high cost of the pigment supplement in poultry feed.

The *Spirodela polyrhiza* was used as fish feed in carp polyculture in the present study and it was estimated that about 4.5 metric ton fish produced per hectare of a ten-month cycle. In this time, 88.5 metric ton *Spirodela polyrhiza* was applied in the pond.

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Abs Nr. OR-044

Remote Sensing And GIS Techniques for Monitoring the Coastal Ecosystem Changes: A Case Study in Tuticorin Coast, India

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The coastal ecosystems are now highly disturbed and threatened due to rapid increase of population and developmental activities along the coast. It is necessary to protect coastal ecosystem to ensure sustainable development. This requires information on coastal wetlands and geomorphology. Remote sensing data have been found to be extremely useful for provide information on this aspects. IRS LISS-II & III satellite data (1988 and 1998), Survey of India Topographic map (SOI 1969) and Naval Hydrographic Chart (NHO, 1975) has been used to generate the coastal ecosystem, coastal land use and land cover, coastal landforms, shoreline and bathymetry maps on 1:50,000 scale. This information has been used for the assessment of present status and identification the changes in coastal ecosystem. The analysis of multi-date coral reef maps showed that 2 km² of reef area in Tuticorin coast have been lost over a period of ten years. The changes in coastal land use/land cover indicate that the major changes occurred in mangrove, crop land, fallow land, agriculture plantation, forest plantation, scrub land, sandy area and tanks. Various coastal landform units have been identified and grouped in to marine, fluvio-marine, fluvial, aeolian and biogenic landforms. The analysis of multi-date shoreline maps showed that 0.84 and 2.73 km² of the mainland coast and 0.35 and 0.13 km² areas of island coast have been eroded and accreted, respectively, in Tuticorin coast. The analysis of multi-date bathymetry data indicates that, the depth of seafloor has decreased along the coast and around the islands. The average reduction of depth in seafloor has been estimated as 0.31m over a period of twenty-four years. Most of the coastal geomorphic features such as spits, back swamp, mud flat, seaward migration of shore line, reduction of seafloor depths and some of the increased land cover features such as mangrove and mud flat etc are indicate that the coast of Tuticorin going on emerging by tectonic movement. The coastal ecosystem particularly coral reef ecosystem is very severely affected by anthropogenic and natural factors. The validation by ground truth has also confirmed these results

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Abs Nr. OR-047

Geochemical and Biochemical Pathways and Fluxes of Inorganic Nutrients in Chaliyar Estuary

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The Chaliyar River estuary is a positive coastal plain estuary of the 3rd largest river in Kerala with total drainage of 2923 km^2. The estuary functions as sinks and transformers to nutrients and the dynamics of nutrient uptake and release, retaining and recycling of nutrients within estuary and relative contribution of external nutrient supply, nutrient budget, geochemical and biochemical pathways were investigated. The studies revealed that the major source of nitrogen in the estuary is the river discharge. During pre monsoon period, the percentage of inorganic nitrogen to total nitrogen pool is at the minimum and the major form is organic nitrogen. During the post monsoon period, the contributions from both these components are almost equal, with a predominance of inorganic form. The dissolved nitrogen components are present in one form or other through out the estuary in all seasons and so nitrogen is not a limiting nutrient for primary production. The urea-N fraction remains < 7% with the lowest levels in pre monsoon. The urea-N and nitrate-N are being utilized simultaneously over a wide range of concentrations by phytoplankton, but have high preference for ammonia-N and urea-N over nitrate and nitrite. The contribution of Ammonia-N to total nitrogen pool is < 10% during monsoon and pre monsoon seasons. The maximum contribution > 25% is in the post monsoon season when the river run off and the tidal intrusion are moderate. The ammonia contribution is mainly by ammonification and transfer of ammonia from interstitial water. When the monsoon discharges are maximum, 80 –90% contribution to the total nitrogen pool is by nitrate-N alone and in the pre-monsoon months, 75-85% of total nitrogen pool is from the organic –N. The net fluxes of inorganic nutrients in monsoon and post monsoon season are very large; with very small positive or negative fluxes for the pre-monsoon months. The high –ve flux of ammonia (-7.6 $mg/m^2/s$ noticed in September at the river mouth (S1) is attributed to the tidal input from coastal waters resulting in the high amounts of organic matter input and its decay and decomposition resulting in high ammonia levels. The average net fluxes are 4.97 $mg/m^2/s$ at S1 and 9.61 $mg/m^2/s$ at S4 (15km upstream) for the monsoon months and are 7.22 $mg/m^2/s$, 8.01 $mg/m^2/s$ at S1 and S4 respectively for the post monsoon months. During pre monsoon period, ammonia is transported towards the river by tidal action and it varied from –0.47 $mg/m^2/s$ to 0.03 $mg/m^2/s$ at S1 and S3 respectively. The net fluxes of nitrite-N are very small except during June (8.0 $mg/m^2/s$) and are directed upstream during the pre monsoon months. The seasonal averages have higher +ve values in upstream

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sections indicating the land derived sources but the magnitude is very low. The direction of nitrate flux is towards the sea for the monsoon and post monsoon periods, indicating a riverine source. The average flux of nitrate is of the order of 134 mg/m^2/s at S4 and 81.09 mg/m^2/s at S1 for the monsoon months and 33.23 mg/m^2/s at S1 and 4.87 mg/m^2/s at S4 in the post monsoon months. During the pre monsoon months, –ve net flux is towards the river and the magnitude decreases towards upstream (-2.9 mg/m^2/s at S1, -0.16 mg/m^2/s at S4). The net flux of phosphate increases from marine end towards riverine end with the monsoon month's average of net flux of 3.52 mg/m^2/s at S1; 4.63 mg/m^2/s at S4. During peak monsoon (July), the net flux has a maximum at S1 due to incursion of phosphate rich upwelled water. During the post monsoon months the fluxes are of the order of 1.87 mg/m^2/s at S1 and 2.82 mg/m^2/s at S4. The net fluxes are very small and directed towards the river in pre monsoon months. Except in the pre monsoon, there is net transfer of nutrients to sea. The net fluxes in down stream sections are less than that of upstream sections as a result of greater tidal influence, biological intake, adsorption to sediments and incorporation into interstitial water. The mean annual fluxes for nitrate-N, Ammonia-N and phosphate-P are 31.01 mg/m^2/s, +3.9 mg/m^2/s, and +2.39 mg/m^2/s respectively. The average peak southwest monsoon transport of nitrate, ammonia and phosphate to sea are 13.7 tons/day, 1.2 tons/day and 0.61 tons /day respectively. The contributions of nutrients from sporadic inputs from ground water seepage, surface run off, precipitation, offshore waters are difficult to quantify and not considered in the present study.

Abs. Nr. OR-054

Coastal Open Space Utilization: Opportunities Along the State of Kerala

D. R. Fernandez[1] and A.N. Balchand[1]

The ocean contains a vast variety of resources that offer a potential solution to the projected shortages of the next century. With the growing population density, the coastal space stands utilized mainly for habitation, thus the coastal ocean did deteriorate rapidly for the 'Benefit of Mankind'.

With the introduction of proper sustainable development plans and the role of engineering in this area, our coastal ocean have been improving rapidly with and without causing much environmental impacts. The guidelines for planning developmental projects have been formulated and necessary legal aspects concerning the law of the sea, coastal zone regulation act etc are in place. The concept of coastal open space utilization is actually a part of an integrated approach by the governments, research institutes, industry & application of state of the art of technology in various fields in the coastal zone for its furtherance and beneficial utilization.

Many a developed and developing countries have applied these plans to their coastal zones. Most countries have utilized their coastal open space for tourism, fishing, construction of ports and harbours, construction of Offshore structures, artificial Islands, airports etc. These fields of interest are discussed for the state of Kerala and similar approaches have been applied for the benefits expected from Kerala coast. The coastal features that influence the socio-economic progress of the state are discussed and appropriate development plans are stated out (without specific priorities). The new areas where developments are most needed are proposed, especially in the field of shipping, Coastal transportation, fisheries, marine parks conservation, human settlement, Inland navigation, ports and harbours are other venues for development.

The state of Kerala has the potential to use its open coastal space in a very efficient manner; with the implementation of the proposed projects in the coastal open space, which require specific engineering feats, the state would invite investments providing reasonable returns and achieve prosperity.

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Abs. Nr. OR-055

Geothermal Energy Resources in On-shore and Offshore Areas of Indian Sub-Continent - Exploration, Assessment, & Development - Outlines of Availability and Strategic Importance.

K.R.Srinivasan[1]

In recent years there has been a considerable interest in the development of geothermal power and this interest has led to increased research into the nature of geothermal system. Geothermal energy is captured by removing the heat from hot waters, which are pumped to the surface through tubewells. Geothermal reservoirs of practical interest must have temperatures in excess of 180°C, an adequate reservoir volume and a sufficient reservoir permeability to ensure sustained delivery of fluid to wells at adequate rates. The shallower the geothermal reservoir, the more economically feasible is its exploitation. For this reason much interest has centered on an understanding of the mechanism, that can lead to high temperature fluids at shallower depths. In this respect the Indian sub-continent offers a vast scope for development of geothermal energy, as the most important usable source, based on the status of geo-tectonic frame-work. The Indian Peninsular Shield (Indian Plate) is one of the major shields of the earth's crust and composed of the Archaean crystalline basement complex of crystalline (igneous) and metamorphic rocks (meta-sediments). These rocks subsequently after formation were subjected continuously by the orogenic and structural deformation forces, an account of "stress" release along weak spot planes under the Global Plate Tectonics (GPT) resulting in the formation of secondary base on the structure, texture and mineral composition. Such activities with time of period has yielded in the form of hot springs recording high temperatures worth considering for the development of geothermal system for beneficial purposes. The brief account on the structural and textural aspects of the basement complex indicating weak zones/planes favourable for the consideration of geothermal energy development is discussed.

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Abs. Nr. OR-056

Fishing in Troubled Water

B. Subramanian[1] and V. Vivekanandan[1]

The Gulf of Mannar is one of the important marine biosphere reserves in South and South-East Asia, where one can find many corals and chain of coral islands from Rameswaram to Tuticorin. The Reserve comprises of a 560 km^2 core area of coral islands and shallow marine habitat, surrounded by a 10 km wide, 160 km long buffer zone. Both the Central and State government designated the coastal marine area of the Gulf of Mannar as a National Biosphere Reserve in 1989 in order to conserve the Gulf's 21 coastal islands and their surrounding different habitats like mangrove, coral and sea grass. This coast is exploited for fishes, seaweeds, molluscan shells and corals by local traditional as well as non-traditional fishers of different communities. They use different types of artisanal and mechanized crafts and various gears to catch fish.

Ramanathapuram and Tuticorin districts are rain fed draught districts and agriculture is not flourishing in these districts. The agricultural villages along the coastal stretches of these districts were mostly depended on either agriculture or toddy tapping from the coconut and palm trees and the same are their traditional profession. The people from the fishing villages along the coast are involved in fishing in the sea of Gulf of Mannar. Since, the opportunities in agricultural sectors are very poor, to protect their livelihood, many of the agricultural labourers switched over to marine fishing and their inflow was triggered by want of manpower in shore seine and mechanized fishing and also the nature of the sea. Some of these fishermen became craft owners in later stage after seeing the profitability in fishing. This ownership process is still continuing and spreading to other new villages. Due to the heterogeneity of the fishing community, a lack of co-operation is prevailing among villages and this makes any one to do any thing in the sea as the same is not possible in other parts of Tamil Nadu coast, where one can find co-operation within the village as well as among the villages in regional or district level regarding fishing. Even though there are enough resources present in the area, mismanagement of the above is the main reason for conflicts among fishermen, between fishermen and government and degradation of ecosystem. These can be rectified if both government and people are willing to involve in co-management in order to share the wealth in sustainable way.

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Abs. Nr. OR-063

Lead Induced Electrolyte Changes and Recovery in a Freshwater Fish *Cyprinus carpio*

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Aquatic environment has become the nodal point of not only serving as the receptacle for the industrial wastes but also an area of intensive research on the hazards of living system. The industrial effluents contaminating aquatic bodies contain a number of toxic metals, which in turn exercise their effects on fish and pose threat to aquatic life because of their persistence. Metals are toxic to aquatic organisms by means of their activity on the surface of the gills. They damage the epithelial membranes and impair the ability of the gills to regulate ions. Metal can also have internal effects as they pass through the gill membranes into the blood stream (Mc Donald et al**.,** 1989).

The toxic metal, lead is a non-beneficial and non-essential element. The main source of lead contamination of the aquatic environments are the industrial discharges from smelters, battery manufacturing units, run off from contaminated land areas, atmospheric fallout and sewage effluents (Kowolenko et al., 1991). The recovery or regaining homeostasis is a combination of different biochemical processes, after exposure to toxicant. It may be dose dependent with reference to certain parameters. The recovery study (electrolyte changes) is very useful in the field of environmental toxicology. The work on the recovery electrolyte after exposed to toxicants are scanty. Hence, the present wok was designed to study the electrolyte (Na^+, K^+ and $Cl^{-)}$ responses of fish *Cyprinus carpio* to lead toxicity at acute and sublethal concentration and the recovery of electrolytes during lead impoverished treatment.

Healthy speciemens of *Cyprinus carpio* a freshwater teleost belonging to the family Cyprinidae were collected from Tamil Nadu Fisheries Development Corporation (TNFDC), Aliyar fish Farm, Tamil Nadu, India and acclimatized to laboratory condition for about twenty days. During this period the fish were fed *ad libitum* with rice bran and groundnut oil cake twice in a day. Water in the tank was changed daily and aerated to ensure sufficient oxygen supply. The tap water was analysed for physico-chemical features as per APHA (1971). Healthy fish with an average weight of 4-5 gm and length of 6-7 cm were selected for the experimental purpose. The median lethal concentration (LC_{50}) of lead nitrate (18.71ppm) was determined for 24 h. by probit analysis method of Finney (1978). Then, $1/10^{th}$ value of the LC_{50} concentration of lead nitrate for 24 h. (1.871 ppm) was taken as the sublethal concentration (Sprague, 1971). The significance between the sample mean of control and experimental fishes was tested using Students 't' test.

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During above treatment, plasma electrolytes were decreased throughout the exposure period. During recovery period, plasma electrolyte levels were gradually recovered when compared to treated groups. The significant recovery of plasma electrolyte levels were more or less equal to control groups. The significant alterations of plasma electrolyte levels are discussed as a biomarkers against xenobiotics.

Abs. Nr. OR-065

Coastal Management Issues and Concerns of Pulicat Lake, Tamil Nadu

Sarah Coulthard[1]

India's wetlands are amongst some of the most threatened eco-systems in the continent. Pulicat Lake situated at the border between Tamil Nadu and Andhra Pradesh is India's second largest brackish water lagoon, covering 600km square. 52,000 people depend upon the lake for their daily livelihood, and this number is increasing. Meanwhile, available evidence suggests that the life-supporting fishery of the lake is in decline, jeopardizing the survival of the fishing communities that have inhabited its shores for generations, and threatening an important national economic and ecological asset.

The causes of this decline are not straight forward, and have been the centre of many debates within the state of Tamil Nadu and further afield. The complexities surrounding the environmental and social structures of Pulicat Lake are such that a multi-disciplinary, cross-departmental approach in its research and management is now vital in order to establish the true picture of what is happening to the lake and its people, and why.

For the past two years PhD research has been carried out in conjunction with the Universities of Bath and Newcastle (in the UK) and Anna University (Chennai). It aims to contribute to the ongoing national and international efforts to understand the social and environmental dynamics of Pulicat Lake and the problems its people face. Through research into the lives and opinions of fisher folk from 5 villages at Pulicat Lake and the gathering of secondary environmental data, the research outputs will be a set of potential coastal management options, specifically designed for Pulicat Lake.

The paper will firstly provide an introduction to the uses of Integrated Coastal Management and interdisciplinary science using Pulicat Lake as a case study example. It proceeds to offer a more detailed insight into some of the problems that Pulicat Lake fishing communities are facing today.

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Abs. Nr. OR-066

Crustacean Fishery Resources of Coastal West Bengal and their Conservation Issues

M.K. Dev Roy[1] and N.V. Nandi[2]

Coastal West Bengal which comprises of North 24-Parganas, South 24-Parganas and East Midnapore districts is dominated by mangroves, estuaries, backwaters and brackish water bheries. All these ecosystems are very rich in fauna including crustaceans, many of which are commercial value. In the present study, crustacean fishery resources of this part of lower Bengal have been listed. The list includes 36 species of prawns and crabs belonging to 15 genera and 8 families that has been documented through field studies, materials present in National Zoological Collections as well as from literature survey. The study reveals highest representations of the family Penaeidae (11 spp.) followed by Portunidae (7 spp.) amoung prawns and crabs respectively. Besides these, a total of 13 species of lobsters and stomatopods are also listed as untapped fishery resources of this region. Data for marine shrimp production (both penaeid and non-penaeid) and crab from the state have been presented. The Major threats to crustacean fishery in the state of West Bengal have also been discussed along with conservation issues.

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Abs. Nr. OR-073

Water Quality and Phytoplankton Production in Palk Bay, Southeast Coast of India

R. Sridhar[1], T. Thangaradjou[1], S. Senthilkumar[1] and L. Kannan[1]

The plant and animal life in the sea is dependent on various physico-chemical factors including nutrients, which are responsible for fertility of the water masses. Having this in mind, the present study was carried out to determine the water quality in terms of physico-chemical characteristics and plankton distribution in the coastal waters of Kattumavadi, Palk Bay for the period from April 2002 to March 2003.

Air temperature varied from 28 °C to 32° C. Surface water temperature varied from 27.00 to 32.00° C. LEC varied from 0.95 to 1.85. Salinity ranged from 26.00 to 34.50 ‰ and the pH ranged between 7.95 and 8.35. Variation in dissolved oxygen content was from 4.15 to 7.18 ml l^{-1}, while the particulate organic carbon (POC) content varied between 0.49 and 2.28 mg Cl^{-1}. Nutrients viz. nitrate (2.15 to 8.28μM) and reactive silicate (5.15 to 12.52 μM) also varied independently. Chlorophyll 'a' content ranged from 0.28 to 1.48 mg m^{-3} and the primary productivity, from 4.19 to 16.08 $mgCm^{-3}hr^{-1}$.

The present study recorded a total of 45 species of planktonic diatoms and one species of blue-green. Percentage composition of the diatoms showed minimum values during the monsoon season and the maximum values during the premonsoon season. Population density of phytoplankton varied from 18,000 to 34,000 cells l^{-1}. Species diversity and richness of phytoplankton were low during the monsoon season and higher during the summer season, influenced by the temporal variations in the physico-chemical parameters recorded at the study area.

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Abs. Nr. OR-081

Development of Shrimp Aquaculture and its Impacts on Environment

M.Jayanthi[1], S.Ramachandran[2]and P. Nila Rekha[1]

Aquaculture has developed rapidly over the last three decades worldwide and one third of world shrimp production is from shrimp farming. Thailand, Ecuador, Mexico, Honduras, Colombia, China, India, Indonesia, Bangladesh, Vietnam, Taiwan and Philippines are some of the countries contributing to shrimp farming significantly. Asian countries contributes to about 60% of the total aquaculture and 244 per cent increase in aquaculture production was reported in Asia from 1986 to 1994. Our country's present total brackishwater area, area under culture and production are 11,90,900 ha; 141501 ha and 66,778 MT respectively. The environmental issues have always been the point of debate in the growth of shrimp farming. This paper gives the detailed statistical outlook of the development of aquaculture world wide and documents associated environmental issues viz Integrated fish farming for reduced use of pesticides, mixed aquaculture mangrove systems for mangrove restoration, economic viability, food security, employment opportunity, loss of ecologically sensitive habitats, deterioration of water quality, impacts of waste and nutrient loading on the environment, loss of agricultural land, conversion of mangroves, salinization, loss of ground water and introduction to exotic species raised over the development. This paper describes some of the elements like pond preparation, liming, seepage control measures, soil fertilization, water management, chlorination, seed selection, seed stocking, feeding and feed management and health management which are important for sustainable development.

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Abs. Nr. OR-082

Applications of Geographical Information Systems and Remote Sensing in Inland Fisheries and Aquaculture: A review.

P. Mahalakshmi[1] and K.Ganesan[1]

The dynamic nature of the marine environment presents many challenges to officials in charge of managing sustainable aquaculture. Traditionally, attempts to extrapolate spatial structure from aquatic environments have relied on very limited samples, based primarily on catch information and/or fishermen's 'word of mouth'. With the advent of technologies such as Geographical Information Systems (GIS) and Remote Sensing (RS), fisheries managers, aquaculturist and commercial operations alike have access to information that helps them achieve their respective goals. As these technologies develop, it will be necessary to frequently assess the resulting positive and negative effects for both the fishing industry and aquatic ecosystems. At present, the majority of studies involving GIS applications to aquaculture and fisheries have focused on minimizing costs for the aquaculture industry. Given the current state of many fisheries, however, it is equally important that these technologies be applied during stock assessments and policy determination.

GIS has been taken up for aquaculture rather slowly, but its use has been investigated and actively promoted over the last ten years. The scale of investigation can vary greatly and GIS models can be based on very large or very small areas, with appropriately different spatial resolutions used for different purposes. Several regional investigations of aquaculture potential have been made, particularly for Africa and Latin America, using relatively simple environmental and resource availability models. A number of national or state level investigations have been conducted successfully, based on a wide range of data on environment, infrastructure, resource availability and socio-economics. Such studies are now being greatly facilitated by the rapidly increasing varieties and resolutions of digital, basic data that are becoming available. These models are particularly useful for guiding national plans, for consideration of food security issues and for investigation of conflict and trade-off between different economic activities.

Site selection for aquaculture planning is a complex task involving the identification of areas that are economically, socially and environmentally suitable, available to aquaculture and commercially practicable. Site selection for aquaculture requires decisions about many factors. The traditional method of resolving these concerns is by individual site assessment. GIS models based on environmental and system considerations have been shown to be an excellent

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tool for detailed facility location, once a preliminary choice of site has been made. In conjunction with remote sensing and direct data collection, GIS can also form the basis for continued monitoring of a site. Recent work has shown that dispersal of solids wastes from a site can be modeled in GIS to great advantage.
This paper reviews GIS work, to date, in relation to problem solving for aquaculture. The paper concludes that while the available GIS software for modeling and simulation is very advanced, some of the desirable features (such as component based technology like re-use and interoperability) cannot be easily delivered using such software. While the research activities in model integration and re-use are making real advances, especially in delivering those features which cannot currently be provided using GIS modeling, that is not occurring in any coordinated or synergistic manner. The ultimate goal should be to provide a fully open system that would allow the aquaculturist to develop component based GIS applications to any aquaculture/fisheries environmental domain. This is still considered to be very much a long-term ambition.

Abs. Nr. OR-100

Development of Perspective Land Use Plan for Coastal Agro-ecosystem in India

S.Natarajan[1], R.Sivasamy[1], P.Saradha[1] and P.Devipriya[1]

The coastal area in India with a total area of 10.8 million hectares are associated with a variety of soils like saline soils, alkaline soils, acid sulphate soils, sandy soils, marshy and waterlogged soils. These soils are predominantly monocropped with rice crop. The mono rice cultivation has impaired soil fertility greatly and productivity has declined.

The coastal ecosystem offers vast scope for a wide variety of fruit and vegetable crops, plantation crops, spices and medicinal plants. Plantation crops like coconut, arecanut, oil palm, cashew, cocoa and spices like black pepper, cardamom, ginger, turmeric and seed species like cumin, coriander, fennel, fenugreek are high value commercial crops to be advocated judiciously in coastal regions. Integrated farming system comprising judicious combination of agricultural crops with animal husbandry, dairying, poultry, duckery, fishery and horticulture has immense scope in the coastal areas.

It has been estimated that the usable underground water potential in the coastal tracts is 21,292 ha-m per year, which is marginally less than one-half of the present total potential of the country. The utilization of this resource in the coastal belts has to be seriously thought of. Low cost brackish water fish culture has immense potential in coastal areas which are dominated by saline soil and water. Expansion of fish culture in ponds in coastal area states in augmenting the fish production without endangering soil and water qualities must be explored.

In the above context, an investigation was undertaken in the agro-ecological sub regions (AESRs) representing the coastal regions of the country. There are 14 AESRs in the country, six situated in the east coast and eight in the west coast. Seven AESRs representing the typical coastal agro-ecosystem, five in the east coast and two in the west coast were selected. The crop production constraints in the selected AESRs were identified. The crops potentially suited to each AESR were evaluated based on landform, soil, climate and hydrology. Field experiments were conducted with the selected crops and alternate land use options were suggested.

The major coastal landforms are coastal sand dunes, coastal sandy plains, coastal alluvium with uplands and lowlands. The alternate land use which are found to be potential on this different land forms are given below.

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Sl. No.	Major land forms	Alternate land use	
		Field / tree / forage crop	Animal component
1.	Coastal sand dune	Casuarina Cashew Paragrass Bermuda grass	Goat
2.	Sandy plain	Vegetables Flowers Fruit crops Forage crops	Poultry Milch animals
3.	Coastal alluvium (upland)	Pulses Oilseed crops Fodder crops Medicinal plants	Cattle Poultry
4.	Coastal alluvium (lowland)	Paddy Pulses Paddy+ Vegetables	Aquaculture

Abs. Nr. OR-101

Training an Effective Tool for Technology Transfer

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Brackish water aquaculture is a high potential sector for a developing country like India. Shrimp farming experienced rapid growth in the recent years and it is widely practiced in the coastal districts in India. The 'gold rush' into shrimp production and subsequent failures were more because of imperfect applications of technology than imperfect culture technology and lack of training Appropriate training to shrimp farmers is an essential and crucial factor. Brackishwater aquaculture would benefit much, if the pertinent gaps were filled. This study deals with the - Training needs of rural women with the emphasis – Training, which is the cutting edge of development. A field survey was conducted at Nagapattinam and Thanjavur districts of Tamil Nadu with purposive sampling procedure. The sample size was 150 respondents from each district. The results revealed that 94.00 percent of the respondents felt the need for training in the prospective avenues in brackishwater aquaculture in the four states. They wanted to undergo regular training. It is the need of the hour to train them with proper information and appropriate technology. A well planned technology programme integrating research, training and extension components, and with an effective feedback mechanism, should be developed. The need based skill oriented training programme should be implemented in order to promote appropriate technologies.

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Geographical Information Systems and Global Positioning system, A Synoptic Monitoring Tool for Management of Coastal Environment in India

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Geographical Information Systems (GIS) is being utilized in many different fields. What was initially designed for geographical use, in time and through accessibility to an increasing amount of computer systems worldwide has become a major visual tool along with Global Positioning System (GPS) which is based on coordinate measurements with the help of several satellites in orbit around the earth. A hand-held satellite navigation system is utilized to find the accurate positional data of the coordinates of a coastline and point location by presenting a latitude and longitude unique to each object measured. Combination of GIS is an important factor in management of coastal line assessments, its surveillance, environmental risk, site assessments, air, water and soil pollution prevention, among others. Keeping all functionality of systems broad outline of coastline management is dealt here. Around 18% of the surface of the globe is occupied by India where a quarter of global primary productivity occurs Where around 60% of the human population lives and two thirds of the world cities with population of over 1.6 million people are located so as it supplies approximately 90% of world fish catch. Dynamics of the coastal circulation in the Arabian Sea and the Bay of Bengal has been visualized from last decade in large-scale. The influence of basin scale currents and their influence on coastal shelf circulation is now essential, even though many aspects still need study. A complete database is required to be fielded in GIS database that enable us to take proper timely care and resources assessment. The databases may help in systematic long-term study of pollutants, in a regional context, and their effects on biota are necessary. Levels and distribution of contaminants need to be measured and monitored over long periods of time, in the water column, the sediment and the biota. Continuous information on the sources of pollution, the routes of distribution in the environment and their progress through ecosystems, is envisaged in this paper. The areas in Mumbai and its surrounding dumping waste to the sea, Hugly river at Kolkatta into Bay of Bengal and a total coastal areas of Gujarath with particular Namada and Tapti river confluences is described and salient featured are enumerated. In this study integrated the Synoptic monitoring tools such as Remote Sensing by satellites(SEASAT, IRS- P 4, the satellite is carrying two payloads Ocean Color Monitor(OCM) and Multifrequency Scanning Microwave Radiometer (MSMR) used because these are some of the most cost effective monitoring tools of modern technology. Quality control through validation and calibration protocols and experiments, becomes an important aspect in this context.

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