



Lake 2008: Conservation and Management of River and Lake Ecosystems

December 22-24, 2008

Venue: Satish Dhawan Auditorium, Indian Institute of Science, Bangalore

**RAMACHANDRA TV, JOSHI NV, SUBHASH CHANDRAN MD,
KRISHNA ALLURI, SHIVAKUMAR AR, GURURAJA KV, DHAVAL J, KARTHICK B,
KHAN MA, HARISH BHAT, SNEHALATHA VK, ALAKANANDHA B,
SUPRIYA G, BOOMINATHAN M & ARUN DT**

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Ministry of Environment and Forests, Govt. of India, Karnataka State Council for Science and Technology,
Indian Institute of Science, Care Earth, National Institute of Hydrology, Ministry of Water Resources

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Biannual Lake Symposium series is being organized since 1998 by Energy and Wetlands Research Group, Centre for Ecological Sciences, Indian Institute of Science involving schools, colleges, Universities, NGO's focusing on conservation of aquatic ecosystems and environmental education among school children. Lake 2008 is the sixth symposium in a decade of dissemination of knowledge on aquatic ecosystems and conservation.

Lake 1998 – Limnology

Lake 2000 – Symposium on Restoration of Lakes and Wetlands held at Center for Scientific and Industrial Consultancy (CSIC) - Auditorium IISc, Bangalore during November 27-29, 2000

Lake 2002 – Symposium on Conservation, Restoration and Management of Aquatic Ecosystems at Center for Scientific and Industrial Consultancy (CSIC) - Auditorium IISc, Bangalore during December 9 - 13, 2002

Lake 2004 –International Conference on Conservation, Restoration and Management of Lakes and Coastal Wetlands held at Bhubaneswar during December 9-13, 2004.

Lake 2006 –Symposium on Environment Education & Ecosystem Conservation held at Rustum Choksi Hall, IISc, Bangalore during December 28-30, 2006.



Conserve or Perish!

Cover Design: Boominathan M

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Programme Schedule

DAY I: 22nd December 2008 Monday

Inaugural Session		8.00-11.00AM
8.00-9.00AM	Registration	
9.00-10.30AM	Inaugural Session	
10.30-11.00AM	High Tea	
11.00-11.45AM	Conservation of River and Lake Ecosystems - Ramachandra TV	
11.45-12.30PM	Flora of IISc Campus – Shankar Rao K	
12.30-1.00PM	Water harvesting: Challenges and Opportunities – Shivakumar AR	
1.00-1.45PM LUNCH		

SESSION-I		Coastal ecosystem: Biodiversity, Livelihood aspects, Conservation	1.45PM-4.00PM
Chairman and Co-chair: Subash Chandran MD, Kartik Shanker, Boominathan M			
Sr. No	Paper Title	Speaker	
2.1	Mangroves: In need of Estuary-based management plans	Subash Chandran MD and Ramachandra TV	
2.2	Sea turtles: Ocean's ambassadors of conservation	Kartik Shanker	
2.3	Bivalves diversity and distribution in relation to salinity	Boominathan M, Subashchandran MD and Ramachandra TV	
2.4	Tsunami impact and morphological changes along the Tamil Nadu Coastal Estuaries	Ramakrishnan N, and Anand PH	
2.5	Grain size variation and Environmental Implications in a Coastal ecosystem- A case Study	Purandara BK, Venkatesh B and Choubey VK	
2.6	Trace organics in sediments in the lower stretch of Ganges Estuary and their Ecotoxicological significance	Santosh Kumar Sarkar	
2.7	Dissolved methane in relation to important nutrient gradients in surface waters of Tapi estuary, Gujarat	Shailendra Viyol and Nirmal Kumar	
2.8	Kali estuary of Karwar – A priority site for <i>in situ</i> conservation of Mangrove flora of Karnataka and the West coast	Jayakara Bhandary M	

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2.9	Diatom flora of Aghanashini estuary mangroves, West coast of India	Smitha, Mustak MS, Karthick B and Ramachandra TV
4.00-4.15PM TEA		
SESSION-II	Lakes and Rivers: Water quality, biotic resources, conservation, restoration and management	4.15-7.00 PM
Chairman and Co Chair : Prasad MNV, Karthick B and Rao GR		
Sr. No	Paper Title	Speaker
1.1	Ecological status of central Western Ghats rivers evaluated using Benthic Diatom communities	Karthick B, Mahesh MK and Ramachandra TV
1.2	Beneficial uses of macrophytes for Wastewater Treatment and Management	Prasad MNV
1.3	Assessment of impact of human interference on river Kali and comparison with least disturbed river Aghanashini in Uttara Kannada district, Karnataka state, India.PART-I Physico-chemical and derived factors and assessment of water quality in two rivers	Bhat DM
1.4	Contamination of Shivapura and Karihobanahalli lakes in Peenya industrial area, Bangalore dist, India	Nandini N, Aboud S Jumbe and Anupama BS
1.5	Circadian variation of physicochemical factors vis-à-vis zooplankton abundance at different seasons in a freshwater lake, at Saheb bundh, Purulia, West Bengal	Subhayan Dutta, Tapan Saha and Aniruddha Mukhopadyay
1.6	Methane in the Ashtamudi lake, Kerala, India	Zachariah EJ and George Thomas
1.7	Behavior and respiratory responses of the freshwater fish, <i>Cyprinus Carpio</i> (Linnaeus) under Quinalophos intoxication in sublethal and recovery tenures	Sameer G Chebbi and David M
1.8	Assessment of water quality and Phytoplankton Communities in lake Chikka Hunsur (Mysore), Karnataka	Veerasha Kumar NS and Hosmani SP
1.9	Influence of limiting factors on Phytoplankton and Coliform Population in an Inundated, isolated Wetland	Cini Oommen C and Nirmal Kumar JI
1.10	limnological studies on Mavinahalla, Lakkavalli range of Bhadra wildlife sanctuary, Karnataka	Raghavendra Gowda HT and Vijaya Kumara

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1.11	Quality of Cavery River Water at Thirumukkadul	Kalavathy S, Selvakumar R, Suresh Kumar P and Revathy S
1.12	Hydrochemistry of Bhandari tank near Haranahalli, Davengere dist of Karnataka	Ramesha Iyyanahalli and Ravi Kumar
1.13	Water quality Index of Tungabhadra river water ecosystem near Harihar town, Karnataka	Manjappa S, Suresh B, Puttaiah ET and Aravinda HB
1.14	Water quality: Lakes of Schirmacher oasis, Antarctica	Pradeep Kumar
1.15	Natural purification of water from Nainital lake: Water quality evaluation	Indu Mehrotra
Concluding Session		
1.16	Video on NUALGI	Bhaskar MV
1.17	Interlinking of Rivers: Conservation Strategies	Madhyastha MN
8.30 PM DINNER		

DAY II: 23rd December 2008 Tuesday

Bird Watching: 7:00-8:30am

SESSION-III Land and Water Interaction 8.30-11.00AM		
Chairman and Co-chair: Vijayakumaran Nair, Rajasri Ray, Daval Joshi		
Sr. No	Paper Title	Speaker
3.1	Importance of sacred groves in watershed management system	Rajasri Ray, Subhash Chandran MD and Ramachandra TV
3.2	City as a hydraulic construction: The water corridors of Kumbakonam	Anitha Suseelan
3.3	Impact assessment of water shed development Programme	Palakshappa K and Nagaraj MK
3.4	Isotopic composition of Mansar lake district Uddhampur, Jammu and Kashmir and its significance in hydrology Investigations	Rai SP and Bhishm Kumar, Omkar Singh and Khobragade SD

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3.5	Myristica swamps: a treasure trove of biodiversity	Joyce Jose, Roby TJ, Ramachandra KK and Nair PV
3.6	Wetland inventory and dynamics in Karnataka using Remote Sensing and Geographical Information System	Ramachandra P Prasad, Chiranjibi Pattanaik and Narendra Prasad
3.7	Ecological status and Environmental flows in Tungabhadra River Basin, India	Harish Kumara BK and Srikantaswamy S
3.8	Impact of historical flows of the Coleroon river on the surrounding Ecosystem	Satyhanathan M, Deepta VT and Selvam V
3.9	Niche analysis and environmental status of river Narmada flood plain ponds	Thamil Chelvan P and Yashika Chelvan

11.00-11.15AM TEA

SESSION-IV

Conservation, Restoration and Management of Ecosystems

11.15AM-1.00PM

Chairman and Co-chair: Shivakumar AR, Umesh DS and Alakananda B

Sr. No	Paper Title	Speaker
5.1	Diatoms of Centenary pond at Indian Institute of Science	Alakananda B and Ramachandra TV
5.2	An approach for restoration of lake ecosystems- A case study of Kundawada lake, situated near Davangere in central part of Karnataka	Manjappa S, Suresh B, Aravinda HB and Desai GP
5.3	Evaluating the effectiveness of elephant proof measures in Keonjhar forest division (territorial), Orissa, India	Mahapatra PK, Mishra SN, Khalid MA and Palei NC
5.4	Eco friendly solar solutions for lake tourism sector	Sivaprasad K and Dileep K Krishnan
5.5	Comparative status of biodiversity and conservation/ management issues of some inland wetlands in Gujarat	Ketan Tatu
5.6	Conservation problems and Management Strategies of Deepor Beel Ramsar site, Assam, India	Chittaranjan Baruah, Jyotismita Das, Naorem Linthoi, Saikia PK and Sharma DK
5.7	Developing Waste Water Treatment Plant using Phytobiofilms in a eutrophic lake	Helen Roselene
5.8	Concerns of farming community in protecting irrigation	Sampath K and Sundaramoorthy T

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	tanks - A study from Tiruvannamalai district of Tamil Nadu, India	
5.9	Impact of electricity industry on environment: Issues and Remedies	Shankar Sharma
5.10	Studies on Restoration and Conservation Strategies for controlling Pollution level of Kaveri River in Thanjavur District Tamil Nadu Using Biological Indicators and Remote sensing	Ramakrishnan N and Anand PH
5.11	Ecosystem health - approach to restoration of wetland resources of Lakshmital lake	Pallavee Tyagi
5.12	Approaches and Components of restoration of Riparian zones: Lessons from central Western Ghats in peninsular India	Keshava H Korse and Sunil Thomas P J

1.00-1.45PM LUNCH

SESSION-V Pollution: Water-Consequences and Remedial Measures 1.45-4.00PM

Chairman: Chanakya N Co- Chair: Durga Madhab Mahapatra and Supriya G

Sr. No	Paper Title	Speaker
7.1	Sustainability and nutrient lock up in Varthur lake ,Bangalore	Mahapatra DM, Chanakya HN and Ramachandra TV
7.2	Exsitu uptake of chromium and growth curve studies of <i>Aspergillus niger</i> & <i>Rhizopus</i> sps.	Ranjini RF, Usha KJ and Angira Devi Bhuyan
7.3	Constructed wetlands as remedial measure for water pollution	Baskar G, Deeptha VT and Abdul Rehman A
7.4	Microbial assessment of Madivala- a rejuvenated lake in Bangalore urban district	Anupama BS, Abodh Jumbe, and Nandini N
7.5	Impact of Sodium Cyanide on Catalase activity in the freshwater exotic Carp, <i>Cyprinus Carpio</i> (Linnaeus)	David M and Vadingadu Munaswamy
7.6	Heptotoxic potentials of malathion in the freshwater teleost, <i>Labeo rohita</i> (Hamilton)	Vineet Kumar, Kallapa Patil and David M
7.7	Heavy metal contamination of selected aquatic Macrophytes in two distinct seasons: A case study of Varasda Wetland, Gujrat, India	Manishita Das, Nirmal Kumar JI and Rita N Kumar
7.8	Bioreduction based bioremediation of hexavalent	Alok prasad Das and Susmita

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	chromium	Mishra
7.9	Pollution status and conservation of lakes in Coimbatore, Tamil Nadu, India	Nishadh KA, Rachna Chandra and Azeez PA
7.10	Determination of the identity of salmon colored H ₂ S producing colony isolates from fish and their characterization by real time PCR	Pranav Garg, Ruth Witkowski and Robert Levin
7.11	Bioremediation of domestic waste water of Thuraiyur municipality	Ashoka Chakkaravarthy Q
7.12	Waste Water Treatment and management in Urban areas – A case Study of Mysore city, Karnataka, India	Shakuntala Bai and Srikantaswamy S
7.13	Status Of Lakes Before And After Restoration – A Case Study On Ulsoor, Sankey, Hebbal & Madival Lakes Of Bangalore, Karnataka	Pattusamy V and Nandini N

4.00-4.15PM TEA

SESSION-VI Biodiversity 4.15-7.30PM

Chairman and Co-chair: Bhat DM, Aravind NA and Ali Rani

Sr. No	Paper Title	Speaker
4.1	Assessment of impact of human interference on river Kali and Comparison with least disturbed river Aghanashini in Uttara Kannada district, Karnataka state, India. PART-II. Phytoplankton composition, species richness, diversity and biological assessment of water quality in two rivers	Bhat DM
4.2	Distribution and seasonal survey of aquatic angiosperms in Chikka biiru lake of Bannerghatta, Bangalore dist, Karnataka	Haridasan VK and Ravi G
4.3	Biodiversity of aquatic insects in some lakes in the Bangalore region	Dinesh Kumar BP and Venkatesha MG
4.4	Aquatic birds of various lakes in greater Bangalore Metropolitan city	Rajashekhar S and Venkatesha MG
4.5	Biodiversity of fish fauna of Sogane and Santhekadur tanks, Shimoga, Karnataka	Venkateshwarlu M, Honneshappa K, Shahnawaz A and Cinchana NV
4.6	Modulation in behavior and respiratory dynamics of the freshwater fish, <i>Cyprinus Carpio</i> (Linnaeus) under Chlorpyrifos intoxication	Ramesh Hallapa and David M

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4.7	The freshwater fish diversity in the tributaries of river Ramganga in the Shiwaliks of the western Himalayas	Vidyadhar Atkore, Shivakumar K and Johnsingh AJT
4.8	Icthyodiversity of Meghalaya	Devi MM and Ramanujam SN
4.9	Fish diversity in relation to water quality of Bhadra Reservoir, Karnataka	Thirumala S, Kiran BR, Kantaraj GS, Puttaiah ET and Prasad D
4.10	Plankton and Faunal Diversity in College Lake at Govt. Arts College, Kumbakonam (Autonomous), Thanjavur District, Tamil Nadu	Victorraj M, Selvam K, Kannadhasan C, Rajasekaran N and Ramakrishnan N
4.11	Comparative Study on Floral Diversity of Kavery River and Five water bodies in and around Kumbakonam Town, Thanjavur District, Tamil Nadu	Selvam K, Victorraj M, Kannadhasan C, Rajasekaran N and Ramakrishnan N
4.12	Diversity of freshwater Mollusc in the Western Ghats	Aravind NA and Madhyastha NA
4.13	Enumeration of wetland Birds in Siddapura pond Bhadravathi, Karnataka	Mohan Kumar BK, Vijaya kumara, Pramod AF and Vinayaka KS
4.14	Plankton of Sita river, tributary of river Tunga, in the Western Ghats, India	Malathi S and Thippeswamy S
4.15	A preliminary study of faunal and floral diversity in two man-made ponds near Kumbakonam, Thanjavur district, Tamil Nadu	Selvam K, Victorraj M, Kannadhasan C, Rajasekaran N and Ramakrishnan N
4.16	Comparative study on faunal and floral Diversity in a pond and Thirumalairayan River in Adambar Padugai village of Thiruvaruar District, Tamil Nadu	Moovendran N, Selvam K and Ramakrishnan K

Parallel session: Students VIII – X

Date: 23rd Dec, 08

Time:9:00-11:00AM

Chairman : Gururaja KV, Karthick B, Amit Yadav and Dhaval Joshi

Sr. No.	School	Paper	Name
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1	Bel vidyalaya [CBSE]	Bangalore lakes and Pandora's box; where is panacea?	Abhishek N
2		Lakes, rivers, estuaries; water quality, biotic resources, conservation, restoration, management	Adithya Upadyaya, Vignesh KR and Disha SR
3	Vikasa High School	Urbanization-impacts on ecosystems	Asha MR
4	KK School, Varthur	Plastics beware!!!	Likith R
5	Sri Kumaran Children's Home, CBSE,	Urbanization-impacts on ecosystems-lake montfort	Mahnaaz Sultana A
6	KK School, Varthur	Diatoms the bioindicators of water pollution	Md. Ismail khan
7	Vikasa High School	Climate change resource and water	Niharika S and Shruthi R,
8	St. Paul's English School	Biodiversity	Nimisha Sharath
9	Holy cross School	Urbanization-impacts on ecosystems	Prasanth Kumar H
10	Holy Cross School	Ecosystem , conservation , restoration management ecosystems	Prashanth K and Mithun S, Sudhanshu Shekhar and Abhilash Sharma, Lavanya S, Monica Sai R and Chaitra S, Suman N and Vijay kumar K, Kavannraj, Bhannu prakash, Chalapathy and Cheeranjeevi
11	KK School, Varthur	Honey bees- The best way to conserve biodiversity	Priyanka Reddy
12		Environmental Education	Rajath R Sawant, Kaushik N Gowda, Varun M Jois
13	DMS NCERT Mysore	Solid state management -	Sadhana J

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		approaches	
14	St. Pauls English School, Bangalore	Bio-diversity	Shishir U
15	Holy Cross School	Land and water interactions	Sindhu B and Pallavi B
16	DM S NCERT	Water quality management for urban lakes	Spandana J
17	KK School, Varthur	Butterflies of KK School	Syed. Imadh

Parallel session: Students XI – XII, UG

Date: 23 rd Dec, 08 Time:11.15-1.00PM			
Chairman: Gururaja KV , Karthick B, Amit Yadav and Dhaval Joshi			
Sr. No.	School	Paper	Name
1	Sri Vani Education centre, Bangalore	Solid waste management	Akshata S
2	Vidyaniketan Public School, Ullal	Diatom based pollution monitoring in lakes	Harini P and Nanditha K
3	Vision PU college, Kalyan nagar, Bangalore	Lakes, rivers, estuaries; water quality, biotic resources, conservation, restoration, management	Mugilvannan
4	Kendriya Vidhyala, Malleshwaram	Water quality and algae of Mathikere lake, Bangalore, Karnataka	Suma KV
5	MSRIT	Mapping of Biodiversity to Evolve Strategies for conservation and Management	Preethi Iyer
6	Mysore University	Environment education	Likith CN

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7	Kongu Engineering College, Erode, Tamil Nadu	Neural based ph system for common effluent plant	Manoj babu D
8	Bharthiar university	Pollution status and conservation of lakes in Coimbatore, Tamil nadu, India	Nishadh KA, Rachna Chandra and Azeez PA
9	Sri Rama Krishna Engineering College, Coimbatore	Scientific requirement for ecosystem based management in the restoration of coastal ecosystem	Rajashekar S
10	SJCE, Mysore	Monitoring the status of urban water bodies	Sahana Jagannath
11	Chirala Engineering College	Importance of Environmental Education for Sustainable Development	Sudhakar RV

Day III: 24th December 2008 Wednesday

SESSION VII Modelling 8:30-11:00AM		
Chairman and Co-chair: Gururaja KV, Uttam Kumar and Amit Yadav		
Sr. No	Paper Title	Speaker
6.1	Conservation priority regions in Uttara Kannada district using Amphibians as surrogates	Gururaja KV and Ramachandra TV
6.2	Modelling and quantification of forest fragmentation	Uttam Kumar and Ramachandra TV
6.3	Effect of meteorological forcing and stratification variability in three morphometrically different urban lakes in Kolkata metro city.	Nihar Ranjan Samal, Mazumdar A, JohnK KD and Peeters F
6.4	Multivariate quality analysis of Cauvery river water around KRS dam, Karnataka	Srikantaswamy, Siamak Gholami, Shakuntala Bai, B.K Harish Kumara and Madhukar
6.5	Application of artificial neural network in Modelling of algal	Amal Raj S and

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	blooms - An overview	Mageshkumar P
6.6	Application of fuzzy indices to determine the trophic status of Pulicat lagoon, southeast coast of India	Harini Santhanam, Mangeshkumar P and Amalraj S
6.7	Prediction of pan evaporation using artificial neural network	Endait MS and Choudary ND
6.8	Diversity models for planktonic algae in lake ecosystems	Shankar Hosmani P
6.9	Lake monitoring using satellite image based on deformable model	Omkar SN and Senthilnath J
6.10	Nygaard's algal Index in Determination of Trophic State index of lake Ecosystem	Mahesh M K and Hosmani SP
6.11	Forest fragmentation in a Micro watershed of West Himalaya	Yadav Amit, Uttam K and Ramachandra TV

11.00-11.15AM TEA

SESSION-VIII Urbanisation: Impacts on Ecosystems 11.15-1.00PM

Chairman and Co-chair: Ramachandra TV and Sudhira H S

Sr. No	Paper Title	Speaker
8.1	Urban Bangalore	Sudhira HS and Ramachandra TV
8.2	Impacts of urbanization on wetlands: A case study - Tumkuru Amanikere	Kokilamani AL
8.3	The impact of urbanization of Tumkur lake - A case study	Ramakrishnaiah CR, Sadashivaiah C and Ranganna G
8.4	Urban heat Islands in the coastal city Interlaced by wetlands	George Thomas and Zachariah EJ
8.5	Baseline study on an eco-restoration process of a hyper - eutrophic urban water body	Prathishta Y, Dirk Walther and Thanasekaran K
8.6	Characterization of leachate and Ground water samples of a municipal solid waste dumping site of Bangalore city, Karnataka	Nandini N, Pavithra S Reddy, Anupama BS and Durgesh R
8.7	Historical evolution of tank system in Bangalore city	Fathima Samana S and Anita Susheelan
8.8	Impact of urbanization on surface, subsurface and ground water quality(A case study for Hebbagodi village Anekal Taluk, Bangalore Urban District)	Chandra Shekar H, Lokesh KV and Ranganna G

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1.00-1.45PM LUNCH		
SESSION-IX	Law, Economic valuation of lake Ecosystem services	1.45-3.00PM
Chairman and Co-Chair: Suryaprakash S, Harish Bhat and Uma HR		
Sr. No	Paper Title	Speaker
9.1	Valuation of Wetland Services	Harish Bhat
9.2	Economic valuation of wetlands: Methods and Emperical Evidence	Anoop P, and Suryaprakash S
9.3	The legal aspects of wetlands conservation in India - An analysis	Nataraju S
9.4	Valuation of lake biodiversity- Essential to control water Pollution in lakes.	Uma HR
9.5	India's national water policy, 2002 in the light of climate change	Asmita Sengupta
9.6	Lake ecosystem in India: Law policy and practice	Pratik Krishan Chadha
9.7	Environmental awareness: A Case study of migrant workers in Ankaleshwar (Gujarat)	Vikas Lakhani
3.00-3.15PM TEA		
Panel session: 3.15-5.30PM		
Parallel session for school Children, Final contest and Poster Presentation		

Poster Presentation

Sr. no.	Name	Address	Poster
1	Lokeshwar S	Holy Cross School	Pollution; Water-consequences and remedial measures
2	Advik V	St. Paul;s English School, Bangalore	Solid waste management
3	Abhilash A	Vision PU College, Kalyan nagar, Bangalore	Pollution: water- consequences and remedial measures
4	Ather Masoodi	Dept. Of Botany, Aligarh Muslim University, Aligarh, India	Ecological Studies on Alien Aquatic Invasive Plants in Walar Lake Of Kashmir
4	Ishwarya B	Vision PU College, Kalyan nagar, Bangalore	Conservation, restoration and management of ecosystems
5	Madhumitha Naik,	National Hill View Public School,	Urbanization

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	Radhika Radhakrishnan and Mridula Nair	Bangalore	
6	Nirmalraj S	Vision PU College, Kalyan nagar, Bangalore	Urbanisation- impacts on ecosystem
7	Varun Bharadwaj and Achal D Arvind		Solid waste management
8	Revathi V	Vision PU College, Kalyan nagar, Bangalore	Solid waste management-approaches
9	Mariselvam A	Chirala Engineering College,A.P	Solid waste management-a good resource to generate Energy and Economy
11	Mohanapriya A	Jeppiar Engineering College, Chennai	The Substantive Role of Ant Biodiversity in Ecosystem Functionality
12	Vishnupriya S	The Valley School, Bangalore	Diversity and Distribution of amphibians across landscapes: A Study in the Valley School, Bangalore Karnataka
13	Sheeba Evangeline J	St. Thomas Town, Bangalore	Herpetofaunal diversity in Prem seva nagar (Narasapura Village , Kolar district, Karnataka)
14	Sonali Pati and Anjan Kumar Prusty B	Gujarat Institute of Desert Ecology, Mundra Road, Bhuj, Gujarat	Eco- Chemical Charecterisation of surface water bodies in and around mining areas of western part of Kachchh, Gujarat
15	Deshkar Sonal , Rathod Jakruthi and Padate Geetha	Dept of Avian Zoology, MS University, Varodara	Comparative study of the waterfowl communities with reference to Narmada inundation
16	Ankitha Parikh and Mankodi PC	Dept of fisheries and Aquatic Biology,	Limnological survey of Sama, the urban pond of Vadodara, Gujarat
17	Rathod Jagruti, Deshkar Sonal, Padate Geeta	Dept of Avian Biology, Dept of Zoology, MS University, Vadodara	Population of Birds in and around three urban ponds with reference to different vegetation cover
18	Feroz Khan, Preetha Panikkar	Reservoir Fisheries division, Central Inland Fisheries Research Institute, Hessarghatta Lake Post, Bangalore	Role of Exotic on the Food web ecology of Kelavarapalli Reservoir Ecosystem

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19	Preetha Panikkar, Feroz Khan M	Reservoir Fisheries division, Central Inland Fisheries Research Institute, Hessarghatta Lake Post, Bangalore	Evolution of Trophic relationship in a productive reservoir in Tamil Nadu
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Valedictory function: 05:30 PM onwards

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SESSION I: Coastal ecosystem: Biodiversity, Livelihood aspects, Conservation

Mangroves: in Need of Estuary-based Management Plans

Subash Chandran MD, Ramachandra TV

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Mangroves play crucial role in coastal productivity and environmental functioning; yet their role is wanting in realistic appreciation. Here is given present picture of mangrove management which lacks approach harmonized with complexities of ecology of individual estuary. India, though rich in mangrove diversity, is also encumbered by lack of comprehensive, habitat specific management plans for estuaries and creeks which are also under tremendous anthropogenic pressures. The flaws in management systems are examined and need for estuary-specific mangrove action plans emphasized. Locality-specific mangrove action plans need to evaluate ecosystem functioning, estuarine history, tidal dynamics, hydrology, soil features, and salinity fluctuations and setting up goals of management. Suitable areas and proper combination of species for planting, including re-introductions and de novo introductions, are to be identified. Community and local institutional participation are desired for program success.

Sea turtles: Ocean's ambassadors of conservation

Kartik Shanker

Centre for Ecological Sciences

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There are seven species of sea turtles in the world, of which five –olive ridleys, leatherbacks, loggerheads, hawksbills and green turtles- are found in India. Olive ridley turtles nest throughout the mainland coast of India. Leatherbacks, hawksbills and green turtles nest in the Andaman and Nicobar Islands. Of Course, the best known nesting ground for sea turtles in India are in Orissa, where thousands of olive ridley turtles make their way to the offshore waters of Gahirmatha, Devi River mouth and Rushikulya, where they congregate and mate. Mass nesting, where as many as hundred thousand turtles nest simultaneously within a few nights, usually occurs between February and April, at one or more of these sites. Sea turtles have faced a number of threats worldwide, leading to the decline and extinction of many populations. They have been exploited for their meat and shell, and many eggs and hatchlings are eaten by feral predators such as dogs and crows. Many indirect threats such as habitat loss, pollution also affect them. Many sea turtles get accidentally caught in a variety of fishing nets, especially trawl

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and gill nets, and drown and die. In India, there are many conservation groups that are in trying to save sea turtles, including fishermen, students, biologists and government departments.

Bivalve's diversity and distribution in relation to salinity

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Bivalves living in the estuaries are termed as euryhaline; they can able to live in the large changes in salinity level. Their distribution varies with respect to changing substrate composition, water quality, notably with regard to salinity in the estuary. Studies reveal the relationship between salinity gradient with occurrence of bivalve species in the Aghanashini estuary, West coast, Karnataka. Bivalve diversity and distribution data obtained from the field survey conducted for 10 months. Data analysis reveals that out of nine bivalve species seven species inhabits the region where the salinity is close to sea water. While species such as *Vellorita cyprinoids* prefers freshwater and tolerate salinity upto 30 ppt. *Katelysia opima* inhabits from 32 ppt to salinity close to seawater.

Tsunami impact and morphological changes along the

Tamil nadu coastal esturaies

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The proposed research would study the Morphological Changes along the East coast river mouth which are widened due to impact of Tsunami. East coast is severely affected due to Tsunami of 26th December 2004 and several morphological changes along the coast happened. There are numerous Major and Minor rivers that mixes with the sea in this region. All the mouths of the rivers are affected due to Tsunami. Apart from the river mouth affected there has been severe impact through out the World. In India sever impact is felt at Nagapattinam district that caused a death of about 6000 lives and loss of several millions. Next to Nagapattinam district, Cuddalore district is worst affected district. Tsunami has caused extensive damages in Andaman and Nicobar Island, Andrapradesh, Kerala and Pondicherry State. The death toll had exceeds about ten thousand in India. The Tsunami disaster also raised important question about the effectiveness of human societies in dealing with such extreme high magnitude in terms of preparedness, the effectiveness of warning system and the ability of the international community to act unilaterally to guide and organize an effective response. River mouths are usually covered with sand, Mangrove forest, and Vegetation cover, Swamps

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and in some cases settlement. The river mouth, which could not resist the force of Tsunami wave, had suspected greater changes. This necessitates a several changes along the coast and various destructions by using optical remote sensing technology. The GPS would used to map the changes at the river mouth through survey method. The study would suggest measures to overcome the problem due to changes in the river mouth due to Impact of Tsunami. Using the optical remote sensing data and the filed data to create a Geographical information system model for disaster reduction in future would generate a geo-spatial data.

**Grain Size Variations and Environmental Implications in a
Coastal Ecosystem – A Case Study**

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The determination and interpretation of particle grain-size has a fundamental role in hydraulics, geomorphology and sedimentology. The study of textural parameters of the sediments is of paramount utility in differentiating various depositional environments. The present study is carried out along the Central Kerala coast. Grain-size data have been collected from various sources. Apart from collected data, few representative surface sediment samples from the downstream of important rivers like Pamba, Manimala, Muvattupuzha, Minachil and Periyar which debauches into Vembanad lake have been collected. Surface and suspended sediment samples were also collected from the Vembanad lake area where the rivers join the lake and the adjacent nearshore area. Beach sediments were also collected from the selected locations. The study revealed a systematic change in grain-size pattern from moving from one environment to another. Coastal waters showed significant quantities of suspended sediment which resulted in the formation of mud banks (wave dampening). It is also observed that the accumulation of finer sediments aid in protecting the coast during southwest monsoon season. A socio economic survey has been conducted in the study area to know the importance and significance of the rare coastal phenomena known as mud banks. Mud banks acts as a treasure house for fishes.

**Trace organics in sediments in the lower stretch of Ganges estuary and their exotoxicological
significance**

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Persistent organic pollutants (POPs) are of global concern due to their widespread occurrence, persistence, bioaccumulation and toxicity to animals and human. The paper critically examines the recent contamination status, distribution and potential pollution sources of these trace organics such as HCH(hexachlorocyclohexane) isomers(HCHs), DDT(dichlorodiphenyltrichloro ethane) and its metabolites (DDTs), HCB(hexachlorobenzene) and congeners of PCBs(polychlorinated biphenyls) and PAH(polycyclic aromatic hydrocarbons) in surface sediments (<63 μ m) from the lower stretch of Ganga River Estuary, eastern part of India. Sedimentary organic carbon and textural properties were also analyzed in order to assess the role of geochemistry on the prevalent POPs contamination.

HCH, DDT, HCB, PCB and PAH were identified compounds in all the samples, whereas the concentrations of chlorinated pesticides (trans-epatochloroepoxide, dieldrin, endrin, metaoxycor and mirex) were below the detection limits and were not of great concern. The pesticides did demonstrate markedly different distributions reflecting different agricultural and domestic usage in the region. An overall elevated level of HCB, DDT and PCB were recorded at Babughat adjacent to the metropolitan mega city Calcutta. The concentration of four important isomers of HCHs reveals a heterogenic distribution where beta and gamma HCH shared the dominant part of total HCH than the alpha and delta isomers. This may be relative to bio-isomerization of HCHs during the process of transformation in these estuarine regions. The relative low percentage composition of alpha HCH is because this congener has a high vapor pressure and Henry's law constant and therefore is readily lost. Low alpha/gamma ratio in the sediment samples was observed which might be due to microbial degradation. Unlike HCH and DDTs, the concentration of HCB did not show any sharp spatial variation. The prevailing sequence of DDT metabolites indicates an active degradation of the parent compound in the sediments and/or inputs of already degraded pp' DDT to the region. Peak concentrations of HCH isomers and DDT metabolites have the potential to induce exotoxicological impact as per the sediment quality guidelines.

Concerning the PCB congeners, tri-chlorinated biphenyls (CB), to octa-CB were detected in the sediment samples. The general decreasing order of seven dominant PCB congeners' contribution to the total load was: PCB 138> PCB 153>PCB 149>PCB 101>PCB 118>PCB 141>PCB 151. This order can be explained by the fact that lightly chlorinated PCBs are less persistent, have lower $\log_{k_{ow}}$ and are more volatile than heavily chlorinated PCBs. Therefore, heavily chlorinated PCBs such as penta, hexa and hepta- chlorinated are more accumulative in the sediments which might be contributed from the commercial mixtures used in transformers, electric equipment and other industries in India, whereas lightly chlorinated PCBs are degraded and volatilized further.

Mean Σ_{22} PAH concentrations in the sediments ranged from 153 to 3242ng g⁻¹ dry weight, with an overall increase of the high molecular PAHs at the site situated at the sea face (Bay of Bengal). Perylene was abundant in the sediments, accounting up to ~ 55% of total PAHs which can be explained by active inputs of soil materials due to frequent strong rain in this tropical climate zone. A rather exception prevalence of high molecular weight PAHs was substantiated: nearly 80% of Σ PAHs include Perylene (11.26%), benzo (a) pyrene (2.32%) and benzo (g, h, i)

Perylene (6.84%). Carcinogenic compounds were present in moderately high (BaP, BkF, BbF) or negligible and low concentrations (DBA, InP) in majority of the cases. The PAH diagnostic ratios indicated that the PAHs in the sediment core were of pyrolytic origin, and that atmospheric deposition and land runoff may serve as the important pathways for PAHs input to the sediment. Fluranthene and Pyrene, the dominant four-ring PAHs, also showed abrupt elevated concentrations at Babughat.

The observed molecular ratios (phenanthrene to anthracene (Ph/An) and fluranthene to pyrene (Fl/Py)) substantiated origin of PAHs from pyrolytic processes due to high combustion inputs and urban runoffs from the urbanized areas. Carcinogenic compounds such as benzopyrene, benzofluranthene were dominant at some sites and total PAHs exceeded the effect- range low values implying occasional or frequent adverse biological effects. The total PAH levels were expressed as the benzo(a)pyrene B(a)P toxicity equivalents (TEQ_s^{carc}) and compared to contaminated sediments from Guba Pechenga, Barents Sea, Russia. The three different approaches chosen for risk assessment of the Ganga river sediments were the consensus SQGs obtained by TEC(Threshold effect concentration), PEC(Probable effect concentration) and EEC(Extreme effect concentration), the threshold/probable effect level (TEL/PEL) approach and finally, the ERL-ERM guidelines.

The authors strongly recommend for (i) regular and reliable monitoring of POPs in this fragile environment so that any exceedance in concentration over the ER-L values can be detected and an appropriate action can be taken and (ii) strong vigilance programme towards installation and maintenance of the waste treatment plants to check the flow of trace organics in the river water. An alarming situation has already been emerged due to presence of pesticide residues in the muscle and blubber in the gangetic dolphin (*Platanista gangetica*), the endangered cetacean mammal declared by the World Conservation Union (IUCN) and also in human milk in various parts of India.

Dissolved Methane in Relation to Important Nutrient Gradients in Surface Waters of Tapi Estuary, Gujarat

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Methane is one of the important greenhouse gases that contribute to a rise in global mean surface temperature due to their relatively high absorption of infrared radiation. Aquatic environments are postulated to contribute > 50% of the total global methane (CH₄) flux to the atmosphere. Methane concentration in surface waters of Tapi estuary, Gujarat, India was measured for short period, from January to July, 2008 in addition to important nutrient gradients like total organic carbon, dissolved oxygen, salinity, phosphate, nitrate and sulphate.

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The mean dissolved CH₄ concentration for all water samples at ONGC Bridge (upper reaches) was 1236.04 nmol/l and at Dumas (lower reaches) was 764.48 nmol /l. The Dissolved methane values observed high at the upper reaches than the lower reaches. The positive correlation was found between dissolved methane and total organic carbon. On the contrary the negative correlation was observed between dissolved oxygen, salinity, phosphate, nitrate and sulphate and methane concentration. The probable causes for varying methane concentration at different reaches and nutrient gradients will be discussed in the paper.

**Kali Estuary of Karwar- A Priority Site for In Situ Conservation of Mangrove Flora of Karnataka
and the West Coast**

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The estuarine complex formed by rivers Kali and Mavinahalla; about three km north of Karwar (Uttara Kannada district of Karnataka) along the West Coast, supports mangrove vegetation along its shores and mud flats. A floristic study has revealed that the isolated and remnant patches of mangrove forest of this area are rich in species diversity of both eumangrove and mangrove associate plants. Of the fifteen species belonging to ten Genera of eumangroves reported from Karnataka, as many as fourteen species belonging to nine genera were found growing here. This includes the major mangrove genera such as *Avicennia* (3 species), *Bruguiera* (2 species), *Rhizophora* (2 species), *Sonneratia* (2 species) and 1 species each of *Acathus*, *Aegiceras*, *Excoecaria*, *Lumnitzera* and *Kandelia*. Among these *Soneratia alba*, *Rhizophora apiculata* and *Avicennia officinalis* are the most dominant species. Occurrence of *Avicennia alba* and *Bruguiera gymnorhiza* which are included in the critically endangered category of IUCN further increases the conservation value of this habitat. The only representative genus of Karnataka mangrove absent here is *Ceriops*. The mangrove associated flora includes more than ten species. Thus, the Kali estuary can be considered as the natural repository of mangrove diversity of Karnataka in particular and of West Coast in general.

However, this valuable habitat of mangrove species is undergoing rapid degradation and fragmentation owing to several anthropogenic activities such as sand mining, biomining for bivalves shells, aqua culture, etc. Therefore, it is necessary to declare the Kali estuary area as a mangrove conservation site and take steps to: 1) protect the remaining patches of mangrove forests, 2) restore the degraded patches by suitable afforestation activities, and 3) enriched the species diversity by introduction of species which are absent.

Diatom Flora of Aghanashini Estuary mangroves,

West coast of India

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Diatoms represent the most important organisms in the aquatic ecosystem. The exploration of diatom flora in taxonomic and ecological context provides enormous information about the habitat. In this attempt the diatom flora in the Aghanashini estuary were explored during Oct 2008. The diatom samples were collected from different habitats like roots of the mangrove, sediment and submerged grass. *Rhizophora mucronata*, *R. officulate*, *Avicennia officinalis*, *Acanthus ilicifolius*, *Cyprus sp.* are the dominant mangrove vegetation in this estuary. Diatoms were identified up to genus level. Across all the habitats 30 genera were identified, among which 25 belongs to the pennate and 5 genera belong to centric forms. *Nitzschia*, *Pinnularia*, *Gyrosigma*, *Navicula*, *Diploneis*, and *Melosira* are the dominate diatom genera, all these genera were represented by more than 2 species. The investigation is in progress to identify diatoms at species level.

SESSION II

Lakes and Rivers: Water quality, biotic resources, Conservation, restoration and management

Ecological status of Central Western Ghats Rivers evaluated using benthic diatom communities

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Diatom assemblage and chemical data were processed to estimate trophic stage and degree of pollution in several rivers in central Western Ghats. The majority of the rivers are unpolluted and some of them polluted; only a few were oligo-mesotrophic. The differences in the water quality of the rivers were reflected by different types of diatom community and also by the values of diatom indices. The analyses showed that ionic contents in water represent important environmental variables accounting for variations among sites and diatom community structure. Several widely distributed diatom species were shown to have similar ecological tolerances in India, compared to Europe and Africa. Most of the diatoms recorded were cosmopolitan and several possibly endemic new species. Diatom indices developed in Europe and elsewhere are useful for characterising water quality. However, there is a need to formulate diatom indices (including endemic species) relevant to tropical and subtropical regions focussing on India. This study confirms that the structure of benthic diatom communities and diatom indices can be applied for monitoring rivers in India.

Beneficial uses of macrophytes for wastewater treatment and management

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In recent past all metros in India have experienced flash floods. Storm water is an important water resource. Storm water storage and treatment is an important topic for tropical countries. This is a neglected area in Indian scenario. Sustainable Urban Drainage Systems, water harvest and water storage and management with macrophytes is a promising field of natural resource management. Constructed wetlands with are designed to intercept and remove a wide range of

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contaminants from waste water. These wetlands can save time and money by using natural mechanisms to treat non-point source pollution. Conventional wastewater treatment plants can effectively remove non-point source pollution, but intensive management is required. The usefulness of macrophytes as biomonitors of polluted environments and as bioremediative agents of urban storm waste waters with select examples are covered in this presentation.

Assessment of impact of human interference on river Kali and comparison with least disturbed river Aghanashini in Uttara Kannada district, Karnataka state, India Part I: Physico-chemical and derived factors and assessment of water quality of two rivers.

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Surface water samples of river Aghanashini and Kali in Uttara Kannada district of Karnataka state were analyzed monthly from March 1996 to Feb 1998 to assess the impact of human induced disturbance on the physico-chemical factors, nutrient load, trophic status, pollution levels and suitability of water for drinking and irrigation. Comparison of the mean values of electrical conductivity, pH, dissolved oxygen, chloride, bicarbonate, total alkalinity, hardness, dissolved organic matter, calcium, magnesium, potassium, sodium, CTI (Composite Trophic Index), SAR (Sodium Adsorption Ratio) and salinity of the rivers showed significant differences. This could be attributed to additional load of nutrient and organic matter through mixing of sewage, industrial effluents and also by way of frequent release of water from the dams as in case of river Kali.

Assessment of water quality on the basis of nutrient load, trophic status and composite trophic index (CTI) value indicated that river Aghanashini and its sampling spots are in the range of first order i.e.4-6. Among the sampling spots of river Kali, Supa spot was also in the first order suggesting least human interference and oligotrophic state of water. But average CTI value of river Kali, and Kadra, Kodsalli and Bommanalli spots, were high and fall in the second order category indicating nutrient enrichment, increased level of pollution and eutrophication. Comparison of average values of different physico-chemical factors with the standards of WHO and ISI revealed that waters of both the rivers are fit for drinking. Average electrical conductivity and salinity values of both the rivers are in class-C₁ excellent category indicating low salinity hazards. So waters of these rivers are suitable for irrigation. Average sodium adsorption ratio (SAR) of the rivers were in S₋₁ class with SAR value < 10, indicating low sodium content in water. Therefore waters of these rivers can be used for irrigating all types of soils. Based on the results of this study over two years it was concluded that river Aghanashini is least contaminated and oligotrophic, while river Kali is getting polluted. Therefore efforts are needed to maintain the oligotrophic status of water in river Aghanashini and to minimise the level of pollution in river Kali.

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**Contamination of Shivapura at Karihobanhalli lakes in
Peenya Industrial Area, Bangalore district, India**

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The color in both the wetland systems was extremely bad ranging over 20 Hazen units. Shivapura- Nalakadarenahalli lake had higher levels of Total Dissolved Solids (TDS) at 1838mg/L compared to 1779mg/L of Karihobanhalli lake. The total hardness for both lakes was found to be above permissible limits. This ionic trend followed $\text{Na}^+ > \text{Ca}^{2+} > \text{Mg}^{2+} > \text{K}^+$ pattern. The trends in anionic variations in the Peenya wetlands were also identical. The levels of Chlorides (Cl^-), Fluorides (F^-), Sulphates (SO_4^{2-}), Phosphates (PO_4^{3-}) and nitrates (NO_3^-) in Karihobanhalli Lake were characteristically higher. The average D.O value for Karihobanhalli Lake was at 3.1mg/L while at Shivapura- Nalakadarenahalli lake it was 2.98mg/L indicating serious levels of organic pollution in the lake. As for the Biological Oxygen Demand (BOD), the maximum was 36mg/L for Karihobanhalli lake while it was 21mg/L for Shivapura- Nalakadarenahalli lake. The minimum was 12mg/L for both the lakes. The Chemical Oxygen Demand (COD) for both lakes was relatively higher with Karihobanhalli lake having a maximum of 187mg/L and the minimum of 80mg/L showing extreme variations on pollutant inputs. In Shivapura- Nalakadarenahalli lake the range fluctuated between 141mg/L and 90mg/L respectively.

**Circadian Variation of Physicochemical Factors vis-à-vis Zooplankton Abundance at Different
Seasons in A Freshwater Lake,
at Saheb Bundh, Purulia, West Bengal**

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Diurnal variation of the physicochemical parameters in an aquatic media is a matter of immense interest, both from the viewpoint of the water chemistry dynamics as well as the behaviour of aquatic organisms. Here an endeavour has been made to note trends of five 22 – 24 December 2008, IISc, Bangalore

parameters like Temperature, pH, Conductivity, Dissolved Oxygen, % Oxygen Saturation, throughout the day. The same has been observed in all three seasons that is Pre-monsoon, Monsoon, and Post monsoon. Results are based on 12 readings a day, at 2 hours interval and it has been established that almost all the parameters have followed the expected trends in day night cycle. In fact pH, Temperature, Dissolved Oxygen and % Oxygen Saturation are positively correlated in almost all seasons. Interestingly, Dissolved oxygen and Oxygen Saturation have followed synchronized ups and downs. ANOVA study also shows the extent of seasonal variation of all those parameters and they are in accord with the hypothesis. Present investigation also depicts that the zooplanktons are completely absent at the surface water at night hours while during daytime they are present as expected. So it might be a reason that light is surely acting as a limiting factor to these aquatic organisms. At the same time it won't be out of place to mention here that the physicochemical factors at night might act as factors influencing the distribution and abundance of zooplanktons.

Methane in the Ashtamudi Lake, Kerala, India

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Wetlands are a major natural source of methane, a greenhouse gas with strong potential for global warming. Methane distribution in the Ashtamudi Estuary (Ramsar Site no 1402) in southern Kerala was investigated. Ashtamudi estuary has a water cover area of 5500 ha, and receives 1300 million m³ water from the Kallada river. Water samples were collected and the dissolved methane was extracted and analysed by gas chromatography. Vertical distribution of dissolved methane was also determined. It is observed that the water is super saturated with methane, at all locations in the estuary. Average concentration of methane in the surface waters during post-monsoon was 314 nmol/l. The values ranged between 49 and 686 nmol/l. Higher concentration was observed near the Kallada river mouth and lower concentration was observed near the confluence zone where the estuary meets the Arabian Sea.

Behavioral and Respiratory Responses of the Freshwater Fish, *Cyprinus carpio* (Linnaeus)

Under Quinalphos Intoxication

In Sublethal Tenures

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A short term definitive test by static renewal bioassay method was conducted to determine the acute toxicity (LC₅₀) of commercial grade organophosphate insecticide, quinalphos (25% EC) on the freshwater fish, *Cyprinus carpio* (Linnaeus). Carp fingerlings were

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exposed to different concentrations (6.64 to 7.88 µl/l) of quinalphos for 96 h. The acute toxicity of quinalphos was found to be 7.5 µl/l. one fifth and one tenth of LC₅₀ (7.5 µl/L) was selected for subacute studies. Behavioural patterns and oxygen consumption were studied in lethal (1, 2, 3 and 4 d) and sub lethal concentrations (1, 5, 10 and 15 d). One (1/5th, 1.5 µl/l) and one tenth (1/10th, 0.75 µl/l) of the acute toxicity value was selected as sublethal concentrations for subchronic studies. The fish were exposed to both the sublethal concentrations for 1, 5, 10 and 15 days. Behavioral responses and respiratory rate were studied in experimental tenures. Fish in toxic media exhibited irregular, erratic, and darting swimming movements, hyper excitability, and loss of equilibrium and sinking to the bottom. Caudal bending was the chief morphological alterations during the exposure tenures. The behavioural and morphological changes might be due to inhibition of acetylcholinesterase (AChE) activity. Inactivation of AChE results in excess accumulation of acetylcholine in cholinergic synapses leading to hyperstimulation and cessation of neuronal transmission (paralysis). The carp were found under stress but mortality was insignificant in both the sublethal concentrations. Considerable variation in respiratory rate was observed in both one fifth and one tenth sublethal concentrations of quinalphos respectively. An alteration in respiratory rates is due to the respiratory distress. This may be a consequence of impaired oxidative metabolism and elevated physiological response by the fish against quinalphos stress. The impairments in fish respiratory physiology and behavioural response even under recovery tenures may be due to slow release of sequestered quinalphos from the storage tissues.

**Assessment of Water Quality and Phytoplankton Communities In lake Chikka Hunsur
(Mysore) Karnataka**

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Lake Chikka Hosur is a closed fresh water lake in the western part of Mysore (Karnataka).It is almost entirely sustained by inflow from the Laxamana thertha river and physico-chemical characteristics and phytoplankton periodicity in Lake were monitored during 2004. All the water quality variables measured showed considerable seasonal variation and quantitative and qualitative differences in phytoplankton communities were recorded. In this lake high abundance of bacillariophyceae were most diverse with bacillariophyceae with 35%,then chlorococcales with 14%, cyanophyceae with 18%, euglenophyceae with 15% and desmidaceae 18%.The identified phytoplankton species indicate a tendency towards eutrophy. Shannon and weaver diversity index, Soyer's frequency index, Dominance index, Despersion index shows Chikka Hosur lake is more polluted with less diversity and is weak eutrophic to highly eutrophic. The diversity and evenness of Plankton species often go hand in hand, frequency of organism is high (only diatoms) but single group of organisms dominate sometimes resulting in blooms. The correlation matrix of Chikka Hosur lake shows a greater number of pairing of parameters and

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will be too tedious and inappropriate to discuss. It is interesting to note that Euglenophyceae shows greater significance in relation to the physico-chemical parameters. Although all parameters at 0.5 level show positive significance. In Chikka Hosur the physico-chemical parameters have an important bearing on the growth of Euglenophyceae. The dendrogram represents a hierarchical organization of the relation between the 26 parameters. At the lowest level all 26 parameters are independent and at the successive levels models are merged until finally, at the highest level all parameters are joined into one group.

**Influence of Limiting Factors on Phytoplankton and Coliform Population in an Inundated,
Isolated Wetland**

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The relationships of phytoplankton with physical (temperature, pH), chemical (dissolved oxygen, calcium hardness, magnesium hardness, chloride, phosphate, sulphate and nitrate) and biotic (total and fecal coliforms) parameters were analysed for the year September 2007 to August 2008 in a seasonally inundated, isolated wetland - Malwar which is situated between 22° 36'55.78" N and 72°54'58.01" E; about 7 kilometres from Anand, near Kanjari- Boriyavi railway station, Central Gujarat, India. Phytoplankton species belonged to Cyanophyceae, Chlorophyceae, Bacillariophyceae and Euglenophyceae. Cyanophyceae members accounted for 68% of the total phytoplankton population, followed by Chlorophyceae, accounted for 23% and the rest 9% were the members of Bacillariophyceae and a single species of Euglenophyceae. ANOVA indicated significant variation in phytoplankton species richness between the two study sites ($P \leq 0.001$). ANOVA indicated no significant variations for phytoplankton densities ($P > 0.05$) between the two sites study. However, significant temporal variation for Cyanophyceae density ($P \leq 0.05$) was indicated. Correlation coefficient matrix for different parameters was calculated.

**Limnological Studies on Mavinahalla, Lakkavalli range of
Bhadra Wildlife Sanctuary, Karnataka**

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A Limnological study was carried out on Mavinahalla (back water of Bhadra Reservoir) in Lakkavalli range of Bhadra Wild Life Sanctuary for a period of one year during 2007-2008. It is a fresh water ecosystem. Its contribution to the ecosystem function is also very significant. Presently it represents the main drinking water source for the fauna of the Bhadra Wildlife Sanctuary. The hydro biological study conducted showed that the concentration of chemical parameters like DO, free carbon dioxide, pH, conductivity, alkalinity, nitrate, phosphate, calcium, manganese, iron are within the permissible levels of drinking water. During the study four different groups of algae viz. Cyanophyceae, Chlorophyceae, Bacillariophyceae and Euglenophyceae were recorded. Among all the groups Bacillariophyceae showed high value of percentage composition.

Quality of Cauvery River Water at Thirumukkudal

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The impact of industrialization and urbanization is felt very much on natural resources especially water and air. Unless the quality is maintained the natural resources would not support human life. Hence, in this study, the quality of Cauvery river water was analysed at Thirumukkudal (Karur District), where many small scale dyeing units, sugar, paper and cement industries are located. Thirumukkudal is the confluence point of river Cauvery and Amaravathy. Beyond the confluence river Cauvery flows as “Akanda Cauvery” (1.5 km across).

To assess the water quality, sampling was carried out at 4 stations designated as station 1 (Cauvery) and station 2 (Amaravathy) constituting the upstream stations and station 3 (Thirumukkudal north) and station 4 (Thirumukkudal south) constituting the downstream stations. The flora and fauna were also investigated. Among the physicochemical parameters of water samples collected in the study stations, significant variations were observed in the colour, turbidity, dissolved oxygen, electrical conductivity, TDS, TSS and alkalinity. All the stations revealed high values of total and fecal coliforms, which made it unfit for consumption. This is due to the open defecation in the river banks. The confluence of two rivers namely Cauvery and Amaravathy has brought about a reduction in the pollution load carried by river Amaravathy.

Rich biodiversity is observed in this area and this may be affected by various human activities such as water pumping, sand dredging, agriculture, sewage and industrial effluent discharges etc. Suitable remedial measures are suggested to conserve the water quality and the riverine ecosystem.

Hydrochemistry of Bandri Tank near Harapanahalli,

Davangere District of Karnataka

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Physico-Chemical characteristic of Bandri tank near Harapanahalli, Karnataka Was studied for period of one year from June 2006 to May 2007. The present investigation is focused on the determination of physico-chemical parameters, Such as water temperature, pH, free CO₂, turbidity, electrical conductivity, hardness, total dissolved solids, total alkalinity, DO, BOD, COD, phosphate, chloride, calcium, Magnesium, sodium, potassium, iron, nitrate and nitrite of water samples from this tank. The aim of this research is to study the extent and reasons of the monthly variations in water quality of Bandri tank. The estimated water quality parameter was compared with BIS standards. Hence, the water is not suitable for human consumption, as it receives the domestic waste water and agriculture run off from the surrounding areas.

Water Quality Index of Tungabhadra River Water Ecosystem near Harihar-Karnataka

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An aquatic ecosystem (habitat and organisms) includes rivers and streams, ponds and lakes, oceans and bays and swamps and marshes and their associated animals. Aquatic ecosystem consists of mainly two types of ecosystems like lentic (standing) and lotic water (flowing) water ecosystem. The term lotic represents running water, where the entire body of water moves in a definite direction. Lotic ecosystems are the flowing water with a longitudinal gradation and characterized by temperature, organic and inorganic materials, energy and the organisms within a stream corridor. Tungabhadra River in Karnataka is an important tributary of Krishna River. It has a drainage area of 71,417 sq.km out of which 57,671 sq.km lies in the state.

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It covers a distance of 293 km in the state and is getting polluted due to rapid industrial growth, domestic and agricultural activities of the region. The River Tungabhadra is formed due to the confluence of two rivers Tunga and Bhadra. The rivers are always the victims of the negative impacts of urbanization. Impacts of sand mining, dumping of waste and sewage are the issues associated with the river Tungabhadra. The water quality index is one of the methods to analyze the pollution load in the river water ecosystem.

The water quality index provides information about the pollution load. The water quality and pollution load of the river Tungabhadra near Harihar, Karnataka was monitored for a period of five Years (December 2000 to November 2005). The quality of water assessed by measuring the water quality parameters such as pH, Total Dissolved Solids, Total Alkalinity, Total hardness, Chloride, Calcium, Magnesium, Dissolved Oxygen, Biological Oxygen Demand. The mean values of water quality indices of all the seasons were recoded for three stations (S_1 , S_2 & S_3). The seasonal investigation has indicated that at station S_1 the water quality index ranged from 54.88 to 69.33 in station S_2 it varied between 70.68 and 70.75 and in station S_3 , it varied between 64.96 and 112.32 in different seasons of the year. Study conducted during the above years, indicate the increasing trend towards pollution and water quality index of the study area. The present paper describes the above study in details. The paper also suggests the need for periodic evaluation of water quality parameters as well as adaptation of proper water quality management practices with a view to protect the riverine ecosystem.

Water Quality: Lakes of Schirmacher Oasis, Antarctica

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The Antarctic continental margins are known for the diverse group of lakes. Lake waters chemically range from distilled water to salt-laden brines. Thirty-eight lakes at the Schirmacher Oasis, Antarctica were surveyed. Conductivity was found to range from 5.50 $\mu\text{S}/\text{cm}$ to 546 $\mu\text{S}/\text{cm}$, a variation of about 100 times. Ionic composition varied from 0.10 meq/L – 10.6 meq/L. Ca^{2+} was found to be the dominant cation and HCO_3^- the dominant anion in majority of the glacier-fed lakes while in case of most inter-mountainous and all the grounding-line lakes Na^+ and Cl^- dominated. Different Schirmacher lakes were found to have sixteen water types. Among them $\text{Na}^+ - \text{Cl}^-$ and $\text{Ca}^{2+} - \text{HCO}_3^-$ types dominated. Results revealed that more than 50% of the lake waters contained (a) alkaline earths > alkaline metals (b) strong acidic anions > weak acidic anions and (c) non-carbonate hardness > carbonate hardness. It could be concluded that even at Schirmacher Oasis, chemical characteristics of unaltered, unpolluted polar lakes vary widely.

Natural Purification of Water from Nainital Lake:

Water Quality Evaluation

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Water from the lake Nainital abstracted through seven tube wells, located at a distance of less than 100 m from the bank is supplied to Nainital. Tube wells draw (a) lake water after passage through the soil i.e. natural filtration and (b) subsurface water/groundwater flowing towards the lake. Water samples from the lake and five tube-wells were analyzed in monsoon and non-monsoon periods from 1997 to 2006. Results indicate that the lake water as such is not potable as it contains unacceptable levels of organic matter in terms of COD, coliform bacteria and nutrients. Coliform bacteria and COD have not been detected in any of the tube-well water samples over the years. Lake water, treated by sand filters did not conform to the drinking water standards. These investigations have led to the closure of the treatment facility and installation of two new tube-wells in addition to the existing five tube-wells.

SESSION III: LAND WATER INTERACTION

Importance of Sacred Groves in

Watershed Management System

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The role of sacred grove in maintaining biodiversity as well as ecological functions in a region are well established nowadays. Although the extent of biodiversity, its importance in economic benefit as well as its conservation measures are well explored, ecological aspects are much overlooked. Sacred groves play important role in soil and water conservation, ground water recharge, nutrient cycling, temperature control, soil quality improvement etc. This report portrays a conceptual framework for understanding the water conservation potential of the groves. Present day groves are the remnants of past vegetation that mostly represent old growth forests in the catchments of river system. In the past, when groves were larger in size they had their usual role in preventing soil erosion, reducing run-offs, generating perennial streams rich with organic matters which can be seen, even today, in many large groves. However, the present day fragmented nature of the groves greatly affects the watershed activity which can be seen through heavy soil erosion, dying of perennial streams as well as deterioration of soil quality. Works have been initiated to assess the potential of the present day groves in water conservation in the background of local landscape. Field survey of the groves reveals their association with water bodies which are seasonal to perennial in nature. Parameters like water holding capacity, soil moisture analysis and ground water recharge are under assessment in grove as well as in surrounding areas to evaluate the role of these groves in water conservation in local landscape.

City as a Hydro centric Construction: The Water Corridors of Kumbakonam City in the Cauvery

Delta

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Historically the relationship of water to urbanization holds a privileged position in India. In this era where water is a shrinking resource the paper underlines the possibility of simultaneously
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protect the landscape and impose radically new spatial configuration in urban development. It discusses one of the hydrological civilizations in the Cauvery Delta – Kumbakonam which has not only imbibed the inherent potentials of the landscape but also followed a hierarchical societal modus, accommodating collective construction, living and maintenance. The worldview, with its mystic reverence for the powers of the nature, evolved a water urbanism transforming nature into culture and subsequently in the shaping of the city. It stresses on the ambivalent relationship between urban & rural, manmade and natural and accommodative and resistive forces and projects how a hydro centric strategy can trigger sustainable form of urbanism. This indigenous regenerative strategy of urban development in concurrence with the natural water structure, though facing a major crisis now, opens up new possibilities of sustainable management of water resources in the region.

Impact Assessment of Watershed Development Programme-

A Case Study of Itagi Sub Watershed

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Soil, Water and Vegetation are the important gifts of nature to mankind. Welfare and development of mankind and his civilization revolves around conservation and development of these vital natural resources, which are so interdependent that one cannot be managed efficiently without the other two. Watershed development programs, which started in India basically as soil and water conservative programs, as a policy response to the increasing environmental crisis and non-sustainability of agriculture especially in the dry land/ semi-arid regions, has modified substantially with the introduction of watershed guidelines in 1994 by the Government of India. In the present study the area considered for assessment is Itagi sub watershed in Ranebennur taluk, Haveri district, Karnataka. In connection with watershed development programme soil and water conservation structures were constructed in the study area during the year 2004. From the analysis of data and results it was found that, there is reduction in soil erosion, improvement in the groundwater recharge, increase in yield of the wells, increase in agricultural production, change in the cropping pattern, improvement in the benefits cost ratio value of various crops and many other tangible and intangible benefits were obtained after the watershed development programme.

Isotopic Composition of Mansar Lake, District Udhampur, Jammu & Kashmir and Its

Significance in Hydrological Investigations

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An attempt has been made to study the isotopic composition ($\delta^{18}\text{O}$ and $\delta^2\text{H}$) of Mansar Lake, a natural lake located in the Himalayan foothill of Jammu and Kashmir, India. The $\delta^{18}\text{O}$ and $\delta^2\text{H}$ composition of the local precipitation, springs, groundwater and the lake are used to study the hydrological behavior of Mansar Lake. It has been observed that lake exhibits a distinct hydrothermal behavior. The lake water mixes completely during the months of January and February and remains stratified in the remaining months. The $\delta^{18}\text{O}$ values of the lake water varies from +1 ‰ to +4 ‰ in surface water and from +1.1 ‰ to +2.6 ‰ in bottom, while the average $\delta^{18}\text{O}$ values for rain water and groundwater are in the order of -6.8 ‰ and -5.3 ‰, respectively. The slope of the rain water (i.e., 8.1) (Local Meteoric Water Line) is found very close to that of the Global Meteoric Water Line, while the slope for lake water is 4.7. The results indicate considerable evaporative enrichment of the lake water. The D-excess values for the lake are observed to vary between 0 ‰ and -15‰, which confirm the significant effect of non-equilibrium fractionation. These results clearly reveal that lake has insignificant interaction with groundwater and lake water is sustained mostly by rainwater which joins the lake as surface runoff and that the water retention period for the lake is very high. The present study throws light on some of the important hydrological characteristics of the lake, which are useful for proper management of the lake.

Myristica swamps: A treasure trove of biodiversity.

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Myristica swamps are one of the most endangered forest ecosystems in the Western Ghats. Sixty swamps in Southern Kerala have been surveyed and mapped recently. The vegetation inside and outside the swamps have been enumerated using a total of 33 sample plots of 0.1 ha area each with subplots of 4x4m and 1x1m for shrubs and herbs. Eighty two trees, ninety four species of herbs/shrubs and 49 climbers constitute the vegetation. Twelve of these plants have been redlisted and up to 28 plants are endemic to Western Ghats. Visual encounter survey (VES), Opportunistic sightings and indirect evidences of presence of animals/disturbances were used to compile the checklists of animals and anthropogenic disturbances. Quantitative data on animals were collected from fifteen swamps in Kulathupuzha Forests Range. The first impression of the faunal composition of Myristica swamps in the study area is the enormity of diversity.

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Fragments of land which have a cumulative area of only 149.75 ha provides habitat for 362 invertebrate species (Platyhelminthes -3 species, Nematelminthes -1species, Annelida -4 species, Mollusca -10 species, Insecta – 281 species, Myriapoda -6 species and Arachnida – 54 species) and 281 vertebrate species (Pices-14 species, Amphibia-56 species, Reptilia-55 species, Aves- 127 species, Mammalia-28 species). The Myristica swamps in the study area have 23 % butterfly, 11% spider, 8.4% fish, more than 50 % amphibian, more than 20 % reptile, 26.6% bird and 6.6 % mammal diversity of Kerala. 16.32 % of the animals recorded from the Myristica swamp are endemic to Western Ghats. 24.20% of the vertebrates recorded from the swamps are redlisted. Though tree composition may take many years to alter, the composition and distribution patterns of susceptible animal communities especially herpetofauna can indicate the health of ecosystems.

Wetland inventory and the dynamics in Karnataka –

A geospatial approach

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Long term monitoring of wetlands is vital for an adaptive management approach and sustainable development. Inventorization and prioritization of small wetlands is one of the critical needs of the hour. A multi-temporal perspective on the wetland distribution in India can only be achieved using satellite remote sensing (RS) and Geographical Information System (GIS). Landsat Thematic Mapper (TM) data for 1990-92 were used for the present study to map wetlands of Karnataka state. The total extent of wetlands for the state is estimated to be 4,488.13 sq km, which is 1,862.63 sq km more than SAC inventory of wetlands. The present paper also highlights the wetland dynamics in select districts of Karnataka using IRS LISS III satellite data.

Study of Environmental Flows in

Tungabhadra River, Karnataka, India

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Environmental water requirements, also referred as 'Environmental Flows', are a compromise between water resources development and the maintenance of a river in ecologically

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acceptable or agreed condition. Dams are often the most significant and direct modifiers of Natural River flows. They are therefore an important starting point to implement environmental flows. Downstream releases from dams are determined by pass water through, over or around the dam. The operating policies and rules determine the amount and timing of releases for environmental flows. Managing environmental water flow is a complex task, because the change of quantity of water occurs as the flow moves downstream. For instance, between a major storage and the places downstream where water is diverted, the quantity of water in a river may be greatly changed from the natural condition and also seasonal pattern of flow may be drastically altered. Further downstream, where a large proportion of the river's water has been removed for human uses is likely to be reduced by the overall flow levels. This paper attempts to present the existing conditions of the water flow from the Tungabhadra (TB) River, and water requirements for the better management of a downstream ecosystem, based on both the field investigations and desk study. A dam across the river TB has reduced the natural flow in the main river. It has altered the socio economic condition of the downstream dependent population of the River. The downstream of the river for 100 km has shrunken in its river bed. The lively support has gradually comedown during last decade leading in shifting of the occupation and migration of the community has commonly registered during the study.

Impact of Historical Flows of the Coleroon River on the Surrounding Ecosystem

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River flows fluctuate on many scales (monthly or seasonal), and the fluctuations are the result of complex non-linear interactions between rainfall processes, topography and geography. The fluctuation in the flow over a time period is also due to the anthropogenic activities like construction of dams, diversions and upstream withdrawals. These fluctuations may have profound effects on ecosystems such as an estuary which has remarkable biological productivity and diversity. As there exists strong correlations between freshwater inflows and the salinity gradients and between salinity and a wide variety of biological productivity, if the quality and quantity of river water is reduced it will affect the health of the estuarine ecosystem seriously. In this context, it is vital to know the dynamics of freshwater river flow reaching the ecosystem i.e. the environmental flow to understand the present status of the system. This study pertains to the Coleroon River, a distributary of the Cauvery River, Tamil Nadu, India and its tail end estuarine ecosystem namely Pichavaram wetlands, which houses a vast diversity of mangrove species covering an aerial extent of 858 ha. As the floristic composition and vegetation community structure in wetlands are determined by frequency, duration, depth and season of flooding, it is necessary to know the present and past status of the Coleroon River,
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which is a dominant source of freshwater for the wetland system. In this work, a desktop analysis is carried out to know the present dynamics of the river by compiling historical records of virgin and present-day monthly average discharge data and other hydrological information such as seasonal index, flood duration curves etc. in various formats. Compilation of flow related information on mangrove ecosystem component is analysed to upgrade the ecosystem to the desired environment management class.

Niche analysis and environmental status of river Narmada flood plain ponds

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River Narmada, the life line of Gujarat forms the one of the largest River Delta estuary at Bharuch District of Gujarat. But except heavy turbulent flood times it forms on its bed several flood plain ponds which are unique lentic freshwater habitats. They are formed beyond the tidal reach and not influenced by tidal saline influx. Some of this ponds act as typical annual types, whereas remaining as perennial types. These ponds support several aquatic macrophytes, belonging to the diverse sections of plant groups like *Spirogyra*, *Chara* (algae), *Azolla*, *Marsilea* (Pteridophyta), *Potamogeton*, *Hydrilla*, *Valisneria*, *Typha*, *Jussiaea*, *Ottelia*, *Nymphioides*, *Ceratophyllum*, *Cypress*, etc (Angiosperms). Using water in some of these ponds for limited time cultivation of river bed land also practiced. For marsh Crocodiles and Phythons these ponds and their surrounding act as ideal Niche. The ephemeral pools formed in the sand habit supports large amount rare *Tripos*. Several little egrets, median egrets, little bittern, great bittern, painted stork, oriental white ibis, black ibis, Eurasian spoonbill, lesser flamingo, shelducks, teals and pochards are making these ponds as their feeding or temporary shelter. Domestic untreated sewage and day-to-day human interference brings large amount pollutants to bank north ponds and industrial effluents a great treat to south bank. Change in seasonal temperature brings drastic alteration in some of these ponds. These wetlands habitats slowly change dry desert like sand dune habitats in severe summer.

**SESSION IV: CONSERVATION, RESTORATION AND
MANAGEMENT OF ECOSYSTEMS**

**Diatoms of Centenary pond at
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Diatoms play a vital role in the food chain of an aquatic ecosystem and are used as bio-indicators. A pond was created in early 2008 at Indian Institute of Science to harvest rain water optimally. This pond was studied for epiphytic and epilithic Diatom flora and water quality variables. Relationships between diatom distribution and environmental variables like pH, DO, hardness and Phosphates were also determined. A total of 11 Diatom genera were recorded and *Pinnularia*, *Navicula* and *Nitzschia* are the dominant in epiphytic, while *Eunotia*, *Gomphonema* and *Nitzschia* are prominent in epilithic habitats. All the genera recorded in this study are cosmopolitan that thrive in mesotrophic condition. The water quality of the pond is under the Indian inland water quality standards.

**An Approach for Restoration of Lake Ecosystems-
a Case Study of Kundawada Lake, Situated Near
Davangere in Central Part of Karnataka.**

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Lakes are considered to be one of the most productive and biologically rich inland surface water ecosystems. Lakes and ponds are depressions containing standing water. A Lake
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can be defined as any large sheet of water occupying a basin, while a Pond is usually considered to be small, with standing water with rooted plants growing in it. Lakes are either naturally formed or man made. In India, even today, many people depend on lakes for drinking and irrigation purposes. Heavy dependence on ground water with an increase in population and erratic urbanization have all led to the slow disappearance of many ponds in India leading to acute ground water depletion and pollution. Hence restoration of lakes and ponds is very much essential and need of the hour. Davangere is a newly formed district with a population of around 5 Lakhs. Davangere city is situated in central part of Karnataka State located in Southern part of India. There are three major lakes in and around Davangere City. These are Bathi Lake, Kundawada Lake and Avaragere Lake. Because of entry of city sewage and agricultural run off, all of these lakes are polluted and the water has become unfit for drinking.

A study has been conducted on Kundawada Lake from April 2004 to March 2006. Detailed analysis of the lake water and the surroundings has been made. Based on the study complete procedure for restoring the lake was prepared including the detailed designs and drawings of Water treatment plant. Accordingly the lake has been restored and is being used as drinking source for Davangere City. The present paper describes details of this study at length.

Evaluating the Effectiveness of Elephant Proof Measures in Keonjhar Forest Division

(Territorial), Orissa, India

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Human-elephant conflict is a major issue at present. A study was conducted during July to December 2007 in Keonjhar Forest Division (Territorial), Orissa, India with an objective to evaluate the effectiveness of elephant proof measures in mitigating the conflict issues. The number of human killings (77 nos.), human injuries (144 nos.), partly house damage (1503 nos.), fully house damage (310 nos.) and crop damage (2779.69 acres) during 2001 to 2007 showed a higher frequency of human elephant interface in comparison to previous years. A total of 10 nos. of electric power fences and 5 nos. of elephant proof trenches/stone walls measuring 43.5 km were mapped during the study with GCP (using Garmin 60). To evaluate the effectiveness of the elephant proof measures the people of adjacent villages were interviewed. Four electric power fences and two elephant proof trenches were effective in minimizing the conflict in 14 villages of Keonjhar Sadar Range and Ghatgaon Range area. The elephant proof measures will be more effective in mitigating the conflict issues by the community participation.

SAF-Eco: Solar Transport System for Lake Tourism

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Eco-tourism is the most sought after activity in the global tourism sector today. India is one of the prime destinations in international Eco-tourism. Lake and inland waterway based tourism plays a vital role in promoting Eco-tourism in our country. Unprecedented inflow of tourists to enjoy voyages in lakes, major rivers and backwaters has created a heavy demand for tourist boat services in these tourist media. The tourist boats use various fuel oils to run the engine and this is a potential cause of pollution of lake waters. Unlike other wetlands, lakes have got a unique problem of fluctuating water levels during various seasons. These fluctuations in water level cause additional problem for the landing facilities for boats used for tourism purpose. This paper proposes multi-faceted solutions for the above-mentioned problems, i.e., pollution and boat landing. Design of a battery powered slow speed tourism cruiser is presented as the main theme of the paper. Feasibility of a jetty, floating at the landing point of the lake, which is also used as a solar power farm cum storage for the charged batteries, is explored and presented.

Comparative Status of Biodiversity and Conservation/Management Issues of Some Inland

Wetlands in Gujarat

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GEER Foundation has conducted studies on some natural and man-made inland wetlands with an aim of inventorying different forms of biodiversity (with emphasis on waterbirds and macrophytic aquatic vegetation) and assessing habitat quality that would be useful for their conservation. These include Chhari Dhandh, Nalsarovar, Thol, Khijadiya and Navatalaav wetlands that are located in different geographic regions of Gujarat state. Two of these (i.e., Nalsarovar and Chhari-dhandh) are natural wetlands, whereas the others are the semi-natural or man-made reservoirs that were originally built for meeting the irrigation water requirements of local people. The major aim of these studies was to It is found that despite their different geographic regions, these wetlands support good to excellent waterbird richness and population. Moreover, natural and shallow water lakes among them support luxuriant aquatic vegetation. Decaying submerged vegetation that can form floating vegetation islands/mats can be considered a major management problem as the 'mats' not only deteriorate habitat quality for waterbirds preferring open water for foraging, but also cause aesthetic deterioration.

Conservation Problems and Management Strategies of Deepor Beel Ramsar Site, Assam, India

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Deepor Beel, the lone Ramsar site in Assam is one of the five most important riverine wetlands situated at the southern fringe of the river Brahmaputra having great biological and environmental importance. The Ramsar site is located within the coordination of 26°03'26"–26°09'26"N and 90°36'39"–90°41'25"E. The area is a home of about 232 species of birds and 64 species of fish in addition to other bio-resources. A survey was made to assess the present threats to the biodiversity in the wetland and to formulate the conservation strategies.

As a part of the conservation of biodiversity, the paper has emphasized on research and conservation initiatives (i) survey of biodiversity, (ii) reproductive cycle of endangered species, (iii) study on allozyme variation and molecular phylogeny to analyze the polymorphism and evolutionary history, (iii) breeding in captivity, and (iv) generate awareness against killing and habitat destruction and need of conservation through community participation.

Developing waste water treatment plant using phytobiofilms in a eutrophic lake

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Bangalore city does not have any perennial river .It is dependent on river Cauvery which is about 140 km away to provide water to its residents pumping water is an expensive business as the population of Bangalore increases the demand for water increases . Eutrophication of lentic water bodies is a problem of increasing environmental and ecological concerns all over and is particularly serious when there is no perennial river My present study is on heavily polluted lake i.e., the Bellandur lake and suggestions to develop waste water treatment plant using phytobiofilms in an eutrophic lake which enables the lake to be remediate. The lake can be located at a latitude 12° - 45' -0"and longitude 77° - 40' - 0". Lake has a submerged area of 915.00 acres. The tank remains full throughout the year since it receives sewage water of about 160 MLD from Bangalore city in addition to its own supply of water of rainfall from its own catchment's area. Study has shown that lake water is highly eutrophicated has DO being 0 mg/L, high phosphate content of 27mg/L. Surprisingly nitrate levels are below the permissible limitThe lead contentat the yemlur sampling site is very high(176.29mg/L)and the water quality indexis 215.7.

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Phytoremediation for treatment of eutrophic lake was taken up using Vetiver and Cana which were grown in small buckets for the removal of N and P containing known concentration of phosphate and nitrate. The total phosphorous and nitrate removed were recorded. The proposed research taken could be applied to transform the polluted lake into a waste water treatment plant using Phytoremediation. This technique plays an important role since the phyto Biofilm (Vetiver and Cana) introduced near the inlet point where the incompletely treated sewage water is discharged. The removal of high phosphate and nitrate from the system could be achieved by introducing autotrophs such as vetiver and canna which are harvestable and represent economic products. Thus ensuring sustainability the system

Concerns of Farming Community in Protecting Irrigation Tanks – a Study from Tiruvannamalai

District of Tamil Nadu, India

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Tiruvannamalai district located at the northern part of Tamil Nadu State is comprised of six taluks viz., Arani, Chengam, Cheyyar, Polur, Tiruvannamalai and Vandavasi. This district is endowed with 1900 irrigation tanks with water-spread area ranging from 5 to 767 ha. The present study was carried out during January and February 2005 to determine the prevailing knowledge and opinion of farmers on the utility values, management and threats of irrigation tanks. Tools namely information schedule, questionnaire and opinionnaire were designed and administered on 264 farmers from 88 tanks with three farmers each. Of the 88 tanks, water-spread area of 34 tanks is above 100 ha each and the total water-spread area of all the tanks is 8492 ha. From these irrigation tanks 2.12 lakh aquatic birds belonging to 69 species were recorded. With the information schedule, complete profiles of sampled farmers and irrigation tanks were collected. The mean percentage of farmers who responded “yes” to two dimensions namely “Utility Values of Tanks” and “Threats of Tanks” under the component knowledge was 55.08% and 56.43%, respectively. Similarly, the mean percentage of farmers who opined positively to the three dimensions namely “Utility Values of Tanks”, “Threats of Tanks” and “Management of Tanks” under the component opinion was 79.17%, 80.46% and 76.07%, respectively.

Impact of Electricity Industry on Environment:

Issues and Remedies

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Electricity Industry has the potential to become the biggest polluter of environment, if not managed carefully. An objective review of the electric power sector in our country and of various energy options available to us will reveal that it is techno-economically feasible to meet the legitimate demand for electricity without having to compromise on environmental and social aspects. The results on a pilot study on Karnataka clearly demonstrate this conclusion.

Studies on Restoration and Conservation Strategies for controlling Pollution level of Kaveri River in Thanjavur District Tamil Nadu Using Biological Indicators and Remote sensing

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The present study area of Kaveri (also spelled Cauvery or Kavery) River is situated in Thanjavur district of Tamil Nadu (between 9 ° 50' and 11 ° 25' of the north latitude and 78 ° 45' and 70 ° 25' of the East longitude). The knowledge about the biodiversity of river along with its present conservation status will help in the wise use of this river, enabling in their sustainable utilization, for the benefit of humankind in a way compatible with the maintenance of its natural properties. Basic information about its biological diversity and integrity, factors influencing their variety and variability, ecological contents and complexes will develop environment sensitive behaviors.

Biological assessment and monitoring of its resources is necessary for understanding the pollution level. The biotic components that support rich biodiversity which includes the phytoplankton, zooplankton, macrophytes, fishes, macro-invertebrates and birds are under threat in most of the rivers and its adjacent water bodies due to anthropogenic pressure as well as point and non-point source of pollution.

From the basic biological data various pollution indices like Saprobic index, Nyggard's index, Palmers' algal pollution index, biological index and Shannon-Weiner index were calculated to quantify the quality of the water bodies. Results showed that the bio-monitoring approaches in Kavery River produced many significant correlations indicating 32 of the 40 comparisons between biological pollution indices (5 kinds) were statistically significant ($r > 0.416$). The Nyggard's index and biological index were significantly correlated with all biological

parameters ($r > 0.342$). Shannon - Weiner index was significantly ($r > 0.325$ and 0.345) associated with phytoplankton population density in all combinations.

The integrity of river ecosystem for its ability to sustain diversity, productivity, self-repair and self-organization can be preserved over time by ecological understanding and skillful actions. The foremost significance necessary to prevent degradation of river ecosystems is to maintain its biological integrity and health. Using remote sensing data in combination with Geographic Information System (GIS) are effective tools for river conservation and management. Remote sensing data are used for the analysis of water quality parameters and modeling. Water quality studies have been carried out using the relationship between reflectance, suspended solid concentration, and chlorophyll-a concentration.

For restoration and management of river pollution proper awareness programmes and education about and for environment is applied to protect the river. The vast potentials of the rivers when used judiciously and sustainably will prevent the undesirable degradation of the river ecosystems. For successful implementation of sustainable development of the river systems, it is necessary to practice favoring steps and procedures like environmental status assessment, environmental impact assessment and environmental planning. Environmental-friendly practices and environmental-sensitive attitudes are the key for sustainable development of the river system.

Ecosystem Health-Approach to Restoration of Wetland Resources of

Lakshmital Lake

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Ecosystem health assessment of an aquatic body is the base to develop scientific management strategy and ecological restoration techniques. In the present study of Lakshmital, four important indicators; water quality assessment, metal analysis, vegetation and socio-economic conditions prevailing in periphery of the lake were selected for its health assessment. The results showed deterioration in water quality since some of the physico-chemical parameters have crossed the permissible limits recommended for a healthy fresh water body, presence of manganese and zinc metals in water and sediment samples in highest concentration, invasion of four aquatic weed species; *Potamogeton zosteriformis*, *Phalaris arundinacea*, *Eichhornia crassipes* and *Elatine triandra* and unhealthy socio-economic conditions.

On the basis of conclusions drawn from the present study; recommendations for management and ecological restoration were proposed accompanying two major techniques; Structural

technique for lake management and watershed management and Non-structural technique for future management and maintenance of the lake.

Approaches & Components of Restoration of Riparian Zones: Lessons from Central *Western*

***Ghats* in Peninsular India**

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Riparian zone is the river corridor region found all along the river course that forms niche habitat by having unique physicochemical & biological properties. The conservation of these habitats has assumed much significance in recent time as they are undergoing severe degradation, mainly due to anthropogenic pressures. Such conservation efforts, especially in the evergreen forest river valley systems in the *Western Ghats* region, become furthermore important due to their high biodiversity value and vital ecological services. Designing & implementing restoration works in riparian ecosystems demand constant inputs from field experiments, as conservation strategies need to be evolved through constant midcourse corrections. This paper has specific inputs for riparian zone restoration programmes on the issues like the choice of implementation strategy through right institutional approaches, the resource utilization modes and the field techniques on ecosystem based approaches to be adopted.

SESSION V: POLLUTION: WATER-CONSEQUENCES AND

REMEDIAL MEASURES

Sustainability and Nutrient lock up in Varthur Lake, Bangalore

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Nutrients such as C, N and P play a vital role in the growth and development of several micro-and macro organisms. The wetland systems such as Varthur lake in Bangalore, albeit being man-made, firstly create a good water balance in the neighbourhood and also act as sink for the pollutants from anthropogenic sources. In peninsular India, it has been traditional to hold runoff rainwater in manmade water bodies called tanks or lakes for later use especially during the dry periods. Greater dependence on ground water has exhausted ground water supplies and we will need to return to surface waters where these above lakes will be important. With increased urbanization, these water bodies are increasingly receiving sewage as a secondary water and are reaching levels of nutrients well above safe limits and often even have become eutrophied. As catchments have dwindled, sustainable use of these water bodies dictates that in future there will be a need to sustain such water bodies in the vicinity of urban and peri-urban areas with the use of both, surface run off during rainy season as well as sewage to meet the short fall. We have examined Varthur lake in this perspective. Varthur lake has received sewage for over 50 years and today receives about 40% of sewage discharge from the city of Bangalore. Sewage brings in large quantities of C, N and P. As the lake also functions as a treatment lagoon, a predominant anaerobic decomposition in the upper reaches of the lake reduces oxygen in the water to 0 mg/L and also brings in some extent of anaerobic sludge. As it flows towards the outlet with about 5-7d HRT, it begins to be aerated and a second type of sludge is formed and settles closer to the outlets. In this study we have characterized the sludge at the lake bottom as a function of the residence time and it shows interesting trends. The tank has been heavily silted and as a result the water storage is quite low compared to its original capacity. Much of the sludge collected at various points in the lake is significantly organic. The quality of the sludge improves as it nears the outlet. The water quality is seen to pass criteria of a conventional treatment system and is therefore the tank may be considered to perform a useful function. The paper presents the results of sludge found at various locations as well as water quality and brings out the threat to sustainability.

Ex-situ uptake of chromium

And growth curve studies of *Aspergillus niger* and *Rhizopus* spp.

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This study has utilized two important and commonly found fungi, both in water and soil – *Aspergillus niger*. and *Rhizopus* spp., to study the ex-situ (laboratory) uptake of chromium by the organisms. The growth curve study of *Aspergillus niger* shows that, for a concentration of 20 µg / 100 ml of media, the maximum uptake of chromium is within the first 4 hours of inoculation (when the addition of metal is simultaneous with inoculation of fungus). There is a steep decrease from 4-8 hours, further increasing between 8-12 hours. Between 12-24 hours there is negligible to nil uptake. Uptake resumes after 24 hours and is completed by 48 hours. From 0-4 hours, pH drops from 5.91 to 5.6, and further increases. This indicates a negative correlation between absorption of chromium and pH. The maximum concentration of chromium that *Aspergillus niger* can tolerate indicates that upto 960 µg / 100 ml of media, there is complete uptake, then it reduces upto 2000 µg / 100 ml of media and beyond that, peaks at 4000 µg / 100 ml of media, further decreasing upto 5000 µg / 100 ml of media. The growth curve of *Rhizopus* spp., for a low concentration of 20 µg/ 100 ml of media, (when inoculation of fungus and addition of metal is simultaneous) shows that the uptake of chromium starts at 2 hours following inoculation and continues till 4 hours, dropping to nil by 6 hours. It further resumes after 6 hours and is completed by 12 hours. When addition of metal is done 10 hours after inoculation, uptake starts immediately and is completed between 11-12 hours. However, when the concentration is increased to 200 µg/ 100 ml of media, uptake occurs till 12 hours, further decreases between 12-20 hours, and then increases. The pH increases from 5.32 at inoculation to 6.4 at 10 hours, and further decreases to 5.5 at 18 hours. This indicates a positive correlation between absorption of chromium and pH. At a concentration of 600 µg/ 100 ml of media, uptake starts at 12 hours, thereafter fluctuating and peaking at 18 and 22 hours. The maximum concentration of chromium that *Rhizopus* spp. can tolerate shows there is complete uptake upto 600 µg/ 100 ml of media, further it reduces marginally till 650 µg/ 100 ml of media and again peaks at 1280 µg/ 100 ml of media. The study forms a basis for further bioremediation studies of utilizing common soil and aquatic fungi for treatment of electroplating and other chromium-containing industrial wastes.

**Constructed Wetland as Remedial Measure for
Water Pollution**

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Root zone treatment is an engineered method of purifying wastewater as it passes through constructed wetland. The pollutants are removed by physical, chemical, biogeochemical processes and by plant uptake. This method is most suitable for schools, hospitals, hotels and for smaller communities. The aim of this pilot research project is to study the effectiveness of the wetland plant *Phragmites australis* in the treatment of wastewater generated in the SRM University premises. A pilot wetland unit of size 1.5mX0.6mX0.3m was constructed in the campus grounds. 3X3 rows of plants were transplanted into the pilot unit and subjected to waste water from the hostels and other campus buildings. The raw wastewater and treated wastewater were collected periodically and tested for quality. It is seen that this pilot unit is reducing the concentrations of TSS, TDS, TN, TP, BOD, COD by 84%, 9%, 96%, 90%, 67%, 73%, respectively.

Microbial assessment of Madiwala – a rejuvenated lake in Bangalore urban district.

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The main objective of this study was to measure the level of fecal contamination in Madiwala Lake using several different techniques of E.Coli estimation and confirmation. The golden green colonies of coliforms with metallic sheen showed a luxuriant growth at 35C with M-Endo Agar.

The growth of both *E. Coli* and *Enterobacter aerogens* using M-Endo Agar Plate was also luxuriant at 35C Temperature. But *E. aerogens* colonies were pink and mucoid while that *E.coli* varied from Pink to Rose-Red with metallic sheen. The MPN Index of 100 ml of the lake sample was found to be 38. Water is generally considered safe for drinking if it contains fewer than 4 coliforms /100 ml. It is also considered safe if it contains less than 2 *Enterococcus* bacteria colonies /100ml of a sample. These observations indicate that environmental status of Madiwala Lake with respect to microbial pollution is continuing to deteriorate. The presence of lethal pathogens such as *E.coli* in the lake are at dangerous and epidemic levels.

Impact Of Sodium Cyanide On Catalase Activity In The Freshwater Exotic Carp, *Cyprinus carpio* (Linnaeus)

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The *Cyprinus carpio* fingerlings on exposure to lethal (1 mg/L) and sub lethal concentrations (0.066 mg/L) of sodium cyanide showed inhibition in the activity of catalase. The disruption of catalase activity in freshwater fish, *C. carpio* is demonstrated in the present study using UV-Visible spectrophotometer at 240 nm using hydrogen peroxide as a substrate. It suggests toxic effects of sodium cyanide and consequent accumulation of hydrogen peroxide in the functionally different tissues namely, liver, gill, muscle, and brain. This might lead to cellular damages, and create widespread physiological disturbance. The results suggest that catalase activity can be a good diagnostic tool for sodium cyanide toxicity in biomonitoring programme

Hepatotoxic Potentials of Malathion in the Freshwater Teleost, *Labeo rohita* (Hamilton)

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Freshwater edible fish, *Labeo rohita* were exposed to sublethal concentration (0.9 µl/L) of commercial grade malathion (50% Emulsifiable concentration) for 5, 15 and 25 d. After each exposure periods, liver was taken to study biochemical alterations. Increase in free amino acid, protease activity and ACh levels, in contrast to decrement in total, structural and soluble proteins and AChE activity were observed in 5 and 15 d of exposure, but on 25 d of exposure all the values reached nearer to normalcy. Restoration of protein fractions, free amino acid, protease activity, ACh levels and AChE activity to normalcy implies that after 15 d of exposure

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there seems to exist an oscillatory phase in protein turnover towards a more synthetic phase leading to the establishment of recuperation and adaptation phenomena.

Heavy metal contamination of selected aquatic macrophytes in two distinct seasons: a case study of Varasda wetland, Gujarat, India.

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The heavy metal contamination of Cr, As, Pb and Cd from selected four native aquatic macrophyte species *Nelumbo nucifera* Gaerth, *Typha angustata* Bory & Chaub, *Ipomoea aquatica* Forsk and *Hydrilla verticillata* (L.f.) Royle, and their components (roots, stems, leaves, flowers) in comparison with sediment and water samples, during two distinct season i.e. summer and monsoon for the month June and October 2008, was carried out in Varasda wetland, situated between 22° 33' N latitude and 72° 38' E longitude of Kheda dist, Central Gujarat, India. The details of the heavy metal concentration in the different plants components and their correlation have been discussed in this paper. The heavy metals in studied plant samples could be arranged in a decreasing order based on their contents as follows: Root system > Shoot system > Leaf system > Flower. Moreover, the mean concentration values of the elements in the plants declined according to this sequence: Cr > Pb > As > Cd, in both the seasons.. During summer *N. nucifera* shown the maximum accumulation of Cr, similarly *T. angustata* of As and *I. aquatica* of Pb. This trend however changed in the monsoons.

Bioreduction based Bioremediation of Hexavalent Chromium

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Presence of Hexavalent chromium in the mineral processing sites is toxic, mutagenic and carcinogenic in nature. The basic process for chromium detoxification involves transformation of Cr⁶⁺ (highly toxic) to Cr³⁺ (less toxic) form. Our study aims to isolate potential strain of chromium reducing bacteria from the chromium contaminated site and to characterize it. The selected strain was capable of catalyzing Cr (VI) reduction thereby decreasing Cr (VI) toxicity and bioavailability. The physico-chemical characteristics of soil sample collected from different chromium contaminated sites of the Sukida mines were studied. Serial dilution technique was followed to isolate the bacterial colonies from the soil sample. Nutrient agar media amended with Cr (VI) at concentrations ranging from 50 to 250 mg/l was carried out for the isolation of

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the chromium resistant bacterial strains. Our basic objective was to optimize the process parameter for industrial application so as to treat hexavalent chromium waste stream from anthropogenic sources.

Pollution Status and Conservation of Lakes in Coimbatore, Tamilnadu, India

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Economic development is accelerating the changes in the land use pattern and land-cover conversion almost throughout India at an unprecedented rate. Wetlands and lakes especially those situated in the vicinity of urban centres have been facing rapid degradation due to liquid or solid waste disposal, filling and reclamation, real-estate ventures and industrial development. Coimbatore, a rapidly developing city in the western part of Tamil Nadu, has several wetlands and lakes in and around its limits. This city wanting facilities for treatment of industrial, municipal, domestic and hospital waste has open drainage and sewerage systems which joining these lakes without any prior treatment. The present study undertaken in Coimbatore during May 2008 on four urban lakes / wetlands namely Ukkadam, Perur, Kurchi and Chinnakulam reports the water quality of these water bodies with reference to the pollution from various sources. The pH for water samples ranged between 7.64 and 8.62. EC and TDS ranged from 303.67 - 4456.7 $\mu\text{S}/\text{cm}$ and 169 - 2079.3 mg/L respectively and were positively correlated with chloride and sulphate ($P < 0.05$). Ukkadam lake, surrounded by textile dyeing industries, municipal markets, dumped domestic wastes was the most polluted among the lakes studied. This lake receives sewage waste along with effluents from dyeing industries through various channels. In view of the findings, recognizing the various ecological services these wetlands offer to the city and its environs regular monitoring of disposal of solid / liquid wastes and sewage discharge is imperative for their conservation.

Determination of the Identity of Salmon Colored H₂S Producing Colony Isolates from Fish and Meat and their Characterization by Real- Time PCR

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Shewanella putrefaciens (formerly *Pseudomonas putrefaciens*) is a spoilage organism in refrigerated foods and can be an opportunistic pathogen. The objective of this work was to confirm the identity of 40 presumptive isolates from Cod and Haddock fillets. These *S. putrefaciens* isolates, both black and salmon colored, were picked from Peptone Iron Agar Plates and streaked for isolation onto Tryptic Soy Agar plates. The 40 isolates and 9 control strains (including *P. putrefaciens* p19x, *S. Putrefaciens* ATCC 8071, *S. Oneidensis* DLM- 7, *S. oneidensis* MR-1, *S. Putrefaciens* ft7, *S. frigidimarina* ATCC 1089 and beef isolates HB1, HB3, HB6) were subjected to 4 metabolic tests and 7 enzymatic tests. Motility was determined by microscopy. Results were compared and the number of presumptives was reduced to 20 by eliminating duplicates. Vitamin requirement studies performed with washed agar on the controls and final 20 cultures revealed that vitamins were not required for growth, however about 0.5% NaCl was required. All 29 cultures demonstrated the ability to grow in the range of 4-32°C. The majority of the isolates were found to resemble *S. frigidimarina* ATCC 1089 and *P. putrefaciens* p19x, but a few were similar to *S. Oneidensis* DLM- 7 and MR-1 in their growth requirements. This was confirmed by Real Time PCR using *S. frigidimarina* primers SFc3f and SFc3r and *S. putrefaciens* primers SP-1 and SP-2 which amplify the DNA from the isolates and controls.

Bioremediation of Domestic Waste Water of Thuraiyur Municipality

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The present study was aimed at using a simple model system for the treatment of Domestic sewage of Thuraiyur Municipality. In order to have a clear idea about the sewage water (S1), and Lake water (S2), the water samples were subjected to physicochemical and bacterial analysis. Total heterotrophic bacterial population was found maximum in sewage water i.e. 2.2×10^5 / mL. Total coliforms and faecal coliforms was high in sewage water i.e. 3.7×10^4 / mL, 1.6×10^3 /100mL. More than 50% reductions of BOD and COD was observed after the treatment. Results indicated that Micrococci and *Pseudomonas* would be a better candidate for continuous treatment of sewage after screened to species level. Further studies

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required to scaling up the methods and transfer of technology in the Bioremediation process for the safe disposal of municipal sewage.

Wastewater treatment and management in urban areas

A case study of Mysore city, Karnataka, India

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Effective collection and treatment of urban wastewater is a critical problem in a developing country like India. Three wastewater treatment plants at Mysore have been taken for the study. The untreated and treated urban waste water was collected seasonally during 2007-08 and analyzed in the laboratory with particular weight age for assessing their agricultural use with respect to water quality and heavy metal concentrations and the results were compared with irrigation water quality standards as per Food and Agriculture Organization (FAO). However, TDS and BOD of the treated urban waste water remain well within the standards. The concentration of heavy metals (Cadmium, Chromium, Copper, Zinc, Iron, Lead, Nickel, in the untreated and treated waste water from all the waste water treatment plants were determined. The Cd, Ni and Cr were not detectable at any stage of the plants. The concentration of Cu, Fe, and Zn were decreased by the treatment plant. The main aim of this study is to analyze the condition of wastewater treatment and management of the Mysore city. The results could be use for further treatment process and reuse of treated water for growing greens, vegetables and for agriculture.

Status of lakes before and after restoration – a case study on ulsoor, sankey, hebbal & madival lakes of Bangalore, Karnataka

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The Lakes in Bangalore form a chain of hydrological connection through them. The flow of water runs from north to south-east as well as south-west along their natural gradient of their land. Central Pollution Control Board(CPCB) carried out water quality monitoring in few lakes in Bangalore. The lakes are Ulsoor, Sankey tank, Hebbal Lake and Madivala Lakes. Water samples were collected and analysed for physico-chemical parameters and Heavy metals. Sludge sample 22 – 24 December 2008, IISc, Bangalore

were collected and analysed for heavy metals. In some of the above lake samples analysis were carried out before lake restoration, after lake restoration and present water quality status. Out of the 5 lakes analysed, Madivala and Ulsoor lakes are showing Phosphate value more than 30ug/L, algal blooms in excess and Nitrogen value exceeded 1500 ug/L which exceeds the standards of unpolluted lakes. Most of the Bangalore lakes are eutrophic in nature.

SESSION VI: BIODIVERSITY

Assessment of impact of human interference on river Kali and comparison with least disturbed river Aghanashini in Uttara Kannada district, Karnataka state, India.

Part II: Phytoplankton composition, species richness, diversity and biological assessment of water quality in two rivers.

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Phytoplankton samples were collected monthly for two years (from March 1996- Feb 1998) from four sampling spots of river Aghanashini and Kali in Uttara Kannada district, Karnataka state, by towing plankton net to assess the biotic composition, phytoplankton density and diversity in the rivers and to assess levels of water pollution considering Palmer's algal species Index and species diversity. It was observed that river Aghanashini supported more number of genera (39) and species (191), while Kali had less number of genera (25) and species (74). Presence of more number of genera and species in river Aghanashini could be due to minimal stress conditions, stable and suitable natural habitats for the survival and multiplication of different species. But occurrence of few genera and species in river Kali could be due to environmental stress conditions such as mixing of sewage and industrial effluents, mining in the river basin and also due to frequent release of stored water from dams leading to storm and unstable conditions. In spite of presence of more number of genera and species in river Aghanashini the average phytoplankton density (26210 O/L) was slightly more than in river Kali (23488O/L). It indicates that few stress tolerant species comprised the majority of population density in river Kali.

In the present study it was observed that Palmer's index of species was 8 in river Aghanashini and it was 11 in river Kali indicating closeness of river Kali to organic pollution and eutrophication. Shannon -Weaver diversity index (H') was 2.91 and 2.26 in river Aghanashini and Kali respectively. Observed greater species diversity index in river Aghanashini and in its sampling spots could be due to stress-free condition and least contamination. Higher species diversity index in Sarkuli spot indicates more equitable distribution of organisms of diverse species .It is also indicative of purity of water and prevalence of oligotrophic condition of water. Lower species diversity index as observed in river Kali could be attributed to environmental stress such as mixing of sewage and industrial effluents and also on account of unstable environment caused by frequent release of water from dams.

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**Distribution and Seasonal Survey of Aquatic Angiosperms in Chikka Bidiru Lake of
Bannerghatta, Bangalore District, Karnataka State**

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Little or no information is available regarding the distribution of aquatic angiosperms of Chikka Bidiru lake which is around 2-3 km from Sarala Birla Academy on Bannerghatta road, Bangalore. The present study was meant to fill the existing lacunae. The study is being conducted since the month of May-June and December to January from 2005-08. The study reveals a drop in the number of aquatic angiosperms from January 2007-08 due to rampant sand mining and usage of soil for manufacturing bricks to meet the growing demand of construction materials in connection with the real estate boom in Bangalore and adjacent areas. Unique to this lake was the large distribution of *Urticularia sp.*, an insectivorous plant which could not be located during the study period of 2007-08. Other angiosperms which could not survive the onslaught of greedy human beings were *Nymphaea sp.* and *Ottelia sp.* However, *Polygonum sp.* and *Ludwigia sp.* have survived the challenging times but even their distribution has become scanty. Unless effective preventive measures are taken on a war-footing, the aquatic angiosperm wealth, may have a very bleak future!

**Biodiversity of Aquatic Insects in Some Lakes
In the Bangalore Region**

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Among the invertebrates the insects dominate fresh water aquatic systems. They are important food sources for fish and birds and play significant roles in nutrient cycling and organic processing. The aquatic insects were quantitatively sampled at five perennial lakes (Byramangala, Hosakere, Lalbagh, Nelligodde and Madivala) existing in and around Bangalore once a fortnight from October 2003 to September 2006 to understand their relationships with water quality.

A total number of 24 different aquatic insect species (dragonflies - 14 species, damselflies - 05, hemipterans-4 and coleopterans - 01) belonging to eight families and three orders was recorded at five lakes. Total number of aquatic insect species recorded at Byramangala, Hosakere, Lalbagh, Madivala and Nelligodde lakes was 13, 13, 08, 11 and 04 respectively. Anisopteran species (dragonflies) recorded at the above five lakes were 09, 10, 06, 05 and 03 respectively. Anisopteran populations were high at Byramangala and Hosakere

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lakes. Among anisopteran, *Brachythemis contaminata* was dominant at all the lakes. Similarly, total number of zygopteran species (damselfies) recorded at Hosakere, Lalbagh, Madivala and Nelligodde lakes was 03, 01, 05 and 01 respectively. Zygopterans were not observed at Byramangala lakes. Among zygopterans, *Ceriagrion coromandelianum* was recorded at all the lakes except Byramangala. Likewise, total number of hemipteran species recorded at Byramangala, Lalbagh and Madivala lakes was 03, 01, and 01 respectively. Hemipterans were not observed at Hosakere and Nelligodde lakes. Hemipterans were abundant only in Byramangala and Madivala lakes. Coleopterans were absent in all the study lakes except Byramangala.

Rank abundance of species shows that dragonfly, *B. contaminata* was highly abundant among the recorded species at Hosakere, Nelligodde and Lalbagh lakes. Similarly, water bug, *Diplonychus rusticus* was highly abundant species at Byramangala, whereas water strider, *Aquarius adelaidis* was abundant at Madivala lake. The richness index for different orders and families based on Menhinick index revealed that Odonata was the richest order in all the five lakes. Of the various families, Libellulidae (Odonata: Anisoptera) was the richest at Byramangala and Madivala lakes, Coenagrionidae (Odonata: Zygoptera) at Hosakere and Nelligodde lakes and Gomphidae (Odonata; Anisoptera) at Lalbagh lake. Frequency index for different aquatic insect species at five lakes showed cent per cent frequency of water scorpion, *Laccotrephes griseus* at Byramangala lake, *B. contaminata* at Hosakere lake, damselfly, *C. coromandelianum*, *Ischnura senegalensis* and *A. adelaidis* at Madivala lake. Similarly, dominance index showed *B. contaminata* was the most dominant at Nelligodde (96.50%), Hosakere (57.50%) and Lalbagh (23.40%), while *A. adelaidis* (77.10%) and *Diplonychus rusticus* (44.60%) were dominant at Madivala and Byramangala lakes respectively.

Comparison of aquatic insect populations belonging to different orders at five lakes showed that anisopterans (adult and naiad) were abundant at Byramangala and Hosakere lakes, while zygopteran (adult and naiad) at Madivala lake. Hemipterans were abundant at Byramangala and Madivala lakes, whereas coleopterans present only at Byramangala lake. Among the anisopteran adults, irrespective of the lakes *B. contaminata* was the most abundant, while *Aethrimanta brevipennis* was the least abundant species recorded during the study period. Similarly, among zygopteran species *I. senegalensis* was the most dominant, while *Pseudagrion microcephalum* was the least dominant species. Among the hemipteran species, irrespective of the lakes *A. adelaidis* was the most abundant, while *Laccotrephes ruber* was the least abundant species recorded during the study period.

The correlation matrix and cluster analysis of insect populations with physico-chemical factors in the lakes showed that most of the aquatic insects especially odonates (dragonflies and damselflies) are able to survive under wide range of fluctuating various physico-chemical factors. In addition, two species of Hemiptera viz., water bug (*D. rusticus*) and water scorpions (*Laccotrephes griseus* and *L. ruber*) and a coleopteran species, *Sternolophus rufipes* were found only in highly polluted Byramangala Lake.

**Aquatic Birds of Various Lakes in
Greater Bangalore Metropolitan City**

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A study on water birds was conducted during February 2008 - September 2008 at selected fifteen major lakes in Greater Bangalore Metropolitan City. The various species of aquatic birds present in the lakes were identified to the species level. The observations were made on the occurrence, activities and abundance of water birds in these lakes. During the studied period 21 species of aquatic birds belong to 11 orders and 11 families were recorded.

The highest percent of all species of water birds was found in Medahalli lake (26.52%) followed by Hebbala (12.18%), Varthuru (9.65%), Anekal (8.61%), Thippagondanahalli (5.54%), Nelamangala (5.46%), Chandapura (5.10%), Lake of Lalbagh Botanical Garden (4.81%), Kengeri (4.72%), Gottigere (3.88%), Jakkuru (3.77%), Hoskote (3.28%) and Somanahalli (3.01%) lakes. In other lakes viz., Ulsooru (0.99%) and Hesarahatta (2.92%) represent very less percent of water birds. The variations in abundance of different species of water birds in these lakes are depending on the availability of sources such as food, water level and nesting sites.

Of the various recorded water birds in the lakes, Cattle egrets (*Bubulcus ibis*), Little egrets (*Egretta garzetta*), Common Coot (*Fulica atra*) and White breasted Kingfisher (*Halcyon smyrnensis*) were commonly found in most of the study lakes. The populations of water birds in the lakes were assessed using various biodiversity indices. The ecobiology of water birds in the lakes will be discussed.

Fish diversity of Sogane and Santhekadur tanks,

Shimoga, Karnataka.

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The present investigation was undertaken to study the fish diversity of Sogane and Santhekadur tanks, Shimoga. About 17 fish species were identified in these tanks which were represented by 4 orders, 11 families and 14 genera. The family Cyprinidae dominated the other groups of fish in both the tanks. The study of fish fauna of an aquatic body is useful for planning of fisheries development. The water quality analysis of these tanks was analyzed to study its influence on fish.

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Modulation in Behavior of the Freshwater Fish, *Cyprinus carpio* (Linnaeus) Under Chlorpyrifos Intoxication

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Effect of chlorpyrifos at different concentrations and exposure tenures were investigated on the freshwater fish, *Cyprinus carpio* to elucidate inhibitory effect of chlorpyrifos on acetylcholinesterase (AChE) activity. Inhibition of AChE activity is considered to be a specific biomarker of exposure to organophosphorous compounds. Carp were exposed to one seventh (0.107 µl/L) and one twelveth (0.062 µl/L) of the lethal concentration (0.75 µl/L) of chlorpyrifos for 1, 7 and 14 days. And allowed to recover in toxicant free medium for seven days. AChE activity was determined spectrophotometrically using acetylthiocholine iodide as substrate in the tissues of brain, gill, liver and muscle. Time and dose dependent inhibition of AChE activity by chlorpyrifos in the tissues of the fish, *C. carpio* is evidenced in the present study. Maximum decrement in AChE activity of the exposed fish was recorded in brain followed by muscle, gill and liver on day 14 in both the sublethal concentrations of chlorpyrifos. Recovery tenures witnessed increment in AChE activity but significantly differed in comparison with control group. Carp in toxic media exhibited erratic, and darting swimming movements, hyperexcitability, and loss of equilibrium and these symptoms were persisted even under recovery tenures. And are due to inhibition of the brain AChE activity. Depression of AChE activity suggests decreased cholinergic transmission and consequent accumulation of acetylcholine (ACh) in the tissues. Excess accumulation of ACh lead to prolonged excitatory postsynaptic potential results in repeated, uncontrolled firing of neurons and cessation of nerve impulse. This has lead to behavioral and morphological changes due to impaired neurophysiology of the fish. Inhibition of AChE activity even under recovery tenures of both the sublethal concentrations can be viewed as higher half-life of chlorpyrifos in vivo and biotransformation of sequestered chlorpyrifos in the storage organs.

The Freshwater Fish Diversity in the Tributaries of River Ramganga in the Shivaliks of the Western Himalaya

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A short study was undertaken from December 2004 to April 2005, to assess the species diversity and composition of freshwater fishes in three tributaries of Ramganga River in the foothills of Western Himalaya. One tributary was within a protected area (Corbett tiger reserve); the other two were outside the protected area. Cast nets were used for fish sampling. Sampling was done from 9.00 am to 5.00 pm.

In total, 43 species belonging to five orders and nine families were recorded. Family *Cyprinidae* was represented by the maximum number of species. Species richness and diversity was high in the protected area. Totally, 28 species were threatened. Similarity in fish composition varied from 60 to 70% across the tributaries. Dynamiting, poisoning, diverting water flows to collect fish are the major threats. Creating awareness, controlling illegal fishing and protecting the breeding grounds of fishes are some of the measures recommended to counter the threats.

Ichthyodiversity of Meghalaya

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Meghalaya situated in the north-eastern region of India, is endowed with a rich variety of flora and fauna. A survey on the ichthyofauna in six districts of Meghalaya has revealed 48 species belonging to 32 genera, 17 families and 6 orders. Major percentage of species belonged to order Cypriniformes followed by the orders Siluriformes and Perciformes represented by 5 families each. The biodiversity of these fauna in different water bodies and their conservation aspects from different districts of Meghalaya are discussed.

Fish Diversity in relation to water quality of Bhadra

Reservoir, Karnataka.

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The fish community of the Bhadra reservoir in relation to water quality was studied by monthly samples taken from June-2004 to May-2005. This water body is situated at 13^o42^l N latitude and 75^o38^l E longitude located near Lakkavalli town of Chikmaglore district, Karnataka and the confluence of the Bhadra river. The water of the reservoir is used for producing
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electricity, fishery and tourism activities. Fish collections were done with gillnets of standardized dimensions with several mesh sizes. 33 fish fauna identified during the study belongs to Cyprinidae 18 species, Channidae 2 species, Bagridae 3 species and a species each of Mastacembelidae, Ambassidae, Cichlidae, Claridae, Notopteridae, Cobitidae and Heteropneustidae. Besides identification, relative occurrence and economic importance of fishes are discussed. All fishes are useful as food fishes except *Ambassis*, *Puntius* and *Gambusia*, which are useful as ornamental and larvicidal fishes. The species diversity is peak in post monsoon, coinciding with favorable conditions such as sufficient water and ample food resources. The diversity was low in premonsoon probably due to the shrinkage of the water spread of the reservoir. The high value of dissolved oxygen coupled with low BOD and other nutrient levels indicate that the water body is moderately oligotrophic in nature. Due to irrational fishing practices, environmental aberrations like reduction in water volume, increased sedimentation and pollution, this diversity is on a decline. To save this diversity and to develop a sustainable fishery practices and proper documentation leading to diversity information system is an urgent need.

**Plankton and Faunal Diversity in College Lake at Govt. Arts College, Kumbakonam
(Autonomous), Thanjavur District, Tamil Nadu**

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Present investigation was carried out in the College Lake situated in the College Campus of Government Arts College (Autonomous), Kumbakonam, Thanjavur District, Tamil Nadu (between 10° 57' and 26° 17' of the north latitude and 79° 22' and 51° 84' of the East longitude) to understand the biodiversity of the Lake. Department of Zoology utilized the lake fish culture over some years. The Phytoplankton population was dominated by 26 species during the study period, the zooplankton population was represented by 8 species, and two amphibian species was recorded in the lake during the study period. Macro benthos was represented by 3 species and 4 species of insect identified during the study period. The lake was occupied by six macrophytic species with four more species were recorded in the banks of lakes. The lake is more productive in terms of fish production. The water level was maintained by pumping the water from Kavery River. Nevertheless there is more close correlation among the plankton population in the experimental pond and the Kavery River. The fish population and the plankton population are negatively correlated. It is interesting to note that two grass species population was negatively correlated with fish population.

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**Comparative Study on Floral Diversity of Kavery River and Five water bodies in and around
Kumbakonam Town, Thanjavur District, Tamil Nadu**

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Comparative study on phytoplankton and macrophytic diversity was carried out in Kavery River (average width of 62.5m) from Swamimalai to Thiruvissannallur for a stretch of 15 Km and with five adjacent water bodies along the course of Kavery River study site (between 10° 57' and 26° 17' of the north latitude and 79° 22' and 51° 84' of the East longitude) to evaluate the pollution level Kavery River as well as the adjacent water bodies by bio-monitoring technique. The phytoplankton population of the Kavery River was represented by 42 species during the study period and only 14 species of Zooplankton was identified. Fish population was dominated by only 7 species and 2 amphibian species, 4 macro-benthos and five insect species were recorded during the study period. Among the macrophytes 4 species identified in Kavery River was dominated by Ipomoea cornia this showed a luxuriant growth in some area of the experimental site and reduce the water flowing region up to 12m so the width of the Kavery River was drastically reduced in the Ipomoea sp dominated regions. The biodiversity data given by co-investigators for other five water bodies were also utilized for further investigation. Among the five water bodies Karuppur Village Tank water is less polluted and during the investigation period showed less turbid nature was achieved by the fish population and submerged Hydrilla sp dominance. In the same way Chetty Mandapam Liliy Lake also showed more clear water with less polluted nature dominated by macrophytes and fish community. The other three water bodies are more polluted nature showed high turbid nature than other two water bodies.

Diversity of Freshwater Mollusc in the Western Ghats

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The Western Ghats is hot spot not only for terrestrial biodiversity, but also for freshwater fauna such as molluscs, crabs and fishes. Indian region harbors nearly 214 species of freshwater mollusc belonging to Gastropoda and Bivalvia. The Western Ghats has 60 species belonging to

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20 genera and 13 families. Freshwater mollusc inhabits both lentic and lotic systems. Number of species in the lotic system is high compared with lentic system. The species which are found in lentic systems such as *Lymnaea*, *Indoplanorbis*, *Gyrullus* etc are very generalist species occurring in polluted waters as well. The bivalves are highly habitat specialist and are sensitive to habitat disturbance. The Western Ghats also home for some zoo-geographically interesting species such as *Cremnoconchus syhadrensis* and *Pseudomulleria dalyi*. The former belong to a marine family of Littorinidae, only this genus is invaded into freshwater systems and is confined to spray zones of the waterfalls. The latter is a one of the three cemented bivalve having origin from Gondwanaland. In this paper we review status, distribution and habitat requirements of freshwater molluscs of the Western Ghats.

Enumeration of wetland birds in Siddapura pond Bhadravati, Karnataka.

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The present investigation based on frequent field visits carried out during March to July 2007. The numbers of these birds were counted using binocular. About 26 species of water birds and water dependent bird species were documented during the census. Out of these 26 species, 13 were (resident), 10 (resident migrant) and 3 (migratory). Important avian species documented during present study were: Little Egret, Pond Heron, Pheasant Tailed Jacana, Bronz Winged Jacana, Coot, Little cormorant, Baya Bird, Black Headed Ibis. We have noted the plant species of this wetland, some of them are *Nymphaea stellata*, *Ipomoea aquatica*, *Justicea simplex*, *Polygonum* sp. *Scoparia dulcis*, *Pistia stratiotes*, and *Eichhornia crassipes* etc a total of 17 species were recorded. The dominated wetland birds of these pond were Little Egret (584 individuals), Pond Heron (459 individuals) and Purple Moorhen (278 individuals).

Plankton Diversity of River Sita, a Tributary of River Tunga in the Western Ghats, India

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Plankton diversity and water quality parameters of river Sita, a tributary of river Tunga, at B. G. Katte near Koppa in the Western Ghats were monitored from January to December 2007. A total of 101 species of plankton belonging to 61 genera of 37 families were recorded. The plankton diversity included the species belonging to chlorophyceae (39 spp.), chrysophyceae (34 spp.), rhodophyceae (2 spp.), cyanophyceae (6 spp.), protozoa (7 spp.), rotifera (2 spp.) nematoda (2 spp.) and arthropoda (7 spp.). Species diversity ($H' \log_e$) and evenness (J') ranged

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from 1.85 (January) to 2.89 (April) and 0.64 (December) to 0.92 (August) respectively. Principal component analysis between biological and environmental variables produced 8 components which accounted for 93.52% of total variance. The component 1 accounted for 32.90% of variance with 8 eigen vectors of both positive and negative correlations. The plots between components 1 and 2 revealed a total of 4 major groups of biological and environmental variables.

**A Preliminary study of Faunal and Floral Diversity in Two Man- made Ponds near
Kumbakonam, Thanjavur District, Tamil Nadu**

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The present investigation was undertaken to understand the biodiversity variation in a highly polluted man-made tank (Manancherry village tank – 3392 sq. m area with an average depth of 2.30 m) and a less polluted man-made pond (Karuppur village pond – 2544sq.m. area with an average depth of 2.12m) near Kumbakonam town (between 10° 57' and 26° 17' of the north latitude and 79° 22' and 51° 84' of the East longitude) of Thanjavur District, Tamil Nadu. Less polluted Karuppur village pond supports more number of submerged and floating hydrophytes than the highly polluted Manancherry village tank. Higher turbidity value was recorded in Manancherry village tank (polluted) support higher number of cyanobacterial population than the other pond (Karuppur village pond) with lower number of submerged species (2 species) and a floating species (only one species). The less polluted Karuppur village pond supports four larger bony fish species in most of the months of a year. So this pond is more productive than the other one. These results statistically proved.

**Comparative Study on Faunal and Floral Diversity in a pond and Thirumalairayan River in
AdambarPadugai Village of Thiruvaruar District, Tamil Nadu**

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A comparative ecological study was undertaken in a small natural shallow Pond and Thirumalairayan River in Adambar Padugai Village for its Floral and Faunal diversity with reference to water quality. For microbiological characteristics analysis water samples collected from three zones in both the water bodies individually and all the samples were combined in 22 – 24 December 2008, IISc, Bangalore

both the water bodies and plankton analysis were carried out. On analyzing the combined sample the first water body (small natural shallow Pond in Adambar Padugai Village) showed less biodiversity than the River site (Thirumalairayan River in Adambar Padugai Village).

The basic biota records were with the phytoplankton recorded the maximum number of species (28), zooplankton species (11), amphibian represented by two species, fish population represented by four species and with macrophytic species represented by 3 species in Thirumalairayan River at Adambar Padugai Village. However in experimental Pond in, Adambar Padugai Village the phytoplankton was dominating (16 species) than zooplankton (8 species) only one amphibian species, three fish species, macro invertebrates 4 species, three water insect species and six macrophytic species were recorded. Among the phytoplankton diatom species was dominated river ecosystem than the experimental pond in Adambar Padugai Village. However in the experimental pond ecosystem the blue green algae were dominated during the study period. Three biological pollution indexes were developed in the present investigation to determine the pollution level of the experimental lentic and lotic water bodies.

SESSION VII MODELLING

Conservation Priority Regions in Uttara Kannada district: Using Amphibians as Surrogates

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Amphibians are regarded as biological indicators and are used as surrogates in conservation and management practices. Uttara Kannada district of Karnataka is the second highest forested region in the entire stretch of Western Ghats (76.29% of its total geographical area). Nearly 80% of over 140 species described from Western Ghats, are endemic to the region. This paper prioritises the regions for conservation using amphibians as surrogates. We adapted river basin approach for sampling strategy, selecting four sampling localities in four major rivers of the district namely, Sharavathi, Aghanashini, Bedti and Kali. Sampling was carried out from 2003-2008, with more emphasis during the monsoon. Ecological variables such as endemics, ecological status and habitat specialist; nineteen bioclimatic variables (worldclim data), in addition to altitude, canopy cover, and enumerated available micro-habitats are used in the analysis. Multivariate analysis is carried to prioritize the regions of conservation importance in the district, which also indicated the regions with more number of endemic species of amphibians.

Modelling and Quantification of Temporal Forest Fragmentation

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Advances in remote sensing science with the availability of multi-sensor, multi-resolution and multi-temporal data have enhanced our capability to analyse temporal changes in landscape patterns. With the urban population increasing at a rapid pace, the change in land use is obvious. Many of the large agricultural land and forest patches are being converted for anthropogenic uses, primarily residential, resulting in decreased forest wealth and sustainability. At this point, it would be relevant to perform landscape characterization, and quantification of the forest fragmentation to take account of the current status of the resources. The outcome would be promising for the local land-use decisions and future actions.

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In this paper, remote sensing data of various resolutions are used to assess the land use dynamics. The data of low spatial resolution is pan sharpened with high spatial resolutions. The data are classified using pattern recognition techniques to obtain the land use classes. The forest fragmentation model is used to visualize the extent of forest fragmentation and to track the change in fragmentation over time. Based on the fragmentation indices, five different forest types are characterized- interior forest, edge forest, transitional forest, patch forest and undetermined forest. Applying the forest fragmentation model on a time series data provided a quantitative assessment of the temporal patterns in forest.

Effect of meteorological forcing and stratification variability in three morphometrically different urban lakes in Kolkata metro city

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Synoptic water temperature measurements were taken in three tropical lakes located within the urban area of Kolkata metro city in eastern India to study the effects of morphometry and the changes in the weather on seasonal, short-term as well as long-term thermal stratification characteristics. Two basins, namely, K & N of the lake, Rabindra Sarobar are considered under identical meteorological forcing while the lake, Subash Sarobar, being comparatively deeper, is considered under different meteorological forcing. Both the Sarobars are separated by an air distance of about 9 km. The dominance of weather over morphometry on the water surface temperature response was illustrated by the synoptic discrete temperature measurements over 2249 Julian days. Stratification structure was also found to be dominated by weather for sufficiently deep lakes. Surface area effects were most subtle but explainable as sheltering effects. The onset of stratification was not, as traditionally described, a simple, gradual response of a lake to the annual solar radiation cycle. Rather it depends on a series of alternate heating, cooling, and mixing cycles similar to annual and diel cycles. The extensive continuous hourly thermal profiles indicating the hydrodynamical events such as stratification as well as mixing throughout that periods is predicted with the help of a one dimensional model and the changes in stratification in three morphometrically different lakes are well reflected in this present paper.

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Multivariate analysis of Cauvery river water quality around KRS dam, Karnataka, India

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It is important to make an assessment of quality for the best use of water resources distribution and utilization. So, study of the relationship of reservoir and river water quality monitoring is most essential aspect for future demand of water for various uses, e.g. irrigation, industries, public health and river conservation. In the present study an attempt has been made to evaluate water quality of Cauvery River around KRS Dam during summer 2008. Ecological parameters like Dissolved Oxygen, Chemical Oxygen Demand, Biochemical Oxygen Demand, and chemical parameters like Total Hardness, Total Alkalinity, Chloride, Nitrate, Phosphate, Sulphate and physical parameters like Temperature, pH, Specific Conductance, Turbidity, Total Solids, Total Dissolved Solid (TDS), Suspended Solids (SS) were analysed and the results were compared with standard permissible limits and hydrological aspect to assess the best designated use of river water for various purposes. Analysis were carried out with various chemical techniques to determine the various physico-chemical characteristics. The differences in various parameters were statistically significant ($p < 0.01$) when compared for the upstream and downstream stretches of the river, particularly in summer. Seasonal water quality has been calculated by correlating various parameters analysed and is compared with WHO standards.

Application of Artificial Neural Network in Modelling of

Algal Blooms– An Overview

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Explosions like formation of algal blooms increasingly pollute both salt and fresh water ecosystems throughout the world. Owing to its negative impacts on human health and aquatic life, this widely reported phenomenon has become a serious environmental problem. While many process based, statistical and empirical models exist for water quality prediction, Artificial Neural Network (ANN) models are increasingly being used for water related applications because ANNs are often capable of modelling complex systems for which behavioral rules or underlying physical processes are either unknown or difficult to simulate. Theoretical knowledge about biological processes can be easily embedded into Neural Network models by means of a constrained training procedure. It is a complex non-linear function with many parameters that are adjusted (calibrated or trained) in such a way that the network output

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becomes similar to the measured output on a known data set. The feed forward neural network models are effective in predicting the non-linear behaviour of algal blooms and the correlation values are as high as 0.95 between the measured and calculated values. This paper presents an overview and provides a systematic approach for modelling the algal blooms using Artificial Neural Networks.

Application of Fuzzy Indices to determine the trophic status of Pulicat Lagoon, Southeast Coast of India

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In the past few years, soft computing techniques, such as fuzzy logic, neural networks and cellular automata that are capable of handling the uncertainty in data and analysis have been used in ecosystem modelling. Fuzzy logic can be used to model non-linear relationships easily and effectively even when only limited data is available. Hence it is possible to construct a fuzzy model based on the known relationships between water quality parameters and the Chlorophyll-a pigment in lagoon waters to obtain the trophic status using the available dataset.

Thus in the present study, standard fuzzy relationships in the form of the fuzzy intersection, were constructed to determine the combined acceptability of chlorophyll –a concentration (as primary productivity), as the lowest of the partial acceptabilities of six major influencing variables – water temperature, secchi disk depth, salinity, dissolved oxygen, total nitrogen, total phosphorus in the water - as an indicator of the trophic status of the lagoon in the years 2005 and 2006. The results obtained from the present study showed that Pulicat lagoon was oligotrophic during the post monsoon and premonsoon periods of 2005, slightly eutrophic in summer of 2005 and mesotrophic during the monsoon periods. The trend was observed to be similar during 2006, excluding the premonsoon period which exhibited oligotrophic condition in the 2006. Evaluation of the performance of the newly created fuzzy model implied that the indices derived using the present method were good representations of the observed actual field conditions.

Prediction of Pan Evaporation Using Artificial Neural Networks

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Water is scarce resource. Scarcity of water may lead to world war-III. Availability of water resources and its management has become important to every nation. Every year billions of cubic meters of water is lost due to evaporation. Present work is a small effort to study the effect plastic balls cover in pan evaporimeter. It was observed in the present study that use of plastic balls in a pan evaporimeter shown considerable reduction in the evaporation loss. Entire area coverage for lake practically may not be feasible therefore study was carried for 25%, 50% 75% and 100% area covered with white plastic balls in a evaporimeter. This study can be simulated to water bodies of dams and lakes. it is observed for 75% coverage of white balls average reduction in evaporation loss was 3.89 mm/day, For 75 % coverage of white balls maximum reduction in evaporation ,loss was noted on 29-05-2008.. Further study may conclude into a good conclusion, which shall help the society to save precious commodity in the form of water.

Diversity Models for Planktonic Algae in Lake Ecosystems

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Ecologists have designed a large range of indices and models for measuring diversity and yet diversity is so hard to define. This is because diversity consists of two components. First, the variety and secondly the relative abundance of species. Diversity can be measured by recording the number of species, by describing their relative abundance or by using a measure which combines the two components. Investigations of ecological diversity are often restricted to species richness, which is a direct count of the number of species present. As is observed no community consists of species of equal abundance. A majority of species are rare, while a number are moderately common, with the remaining few species being very abundant (Magurran, 1983). A variety of species abundance distributions have been proposed to describe the observed patterns. Environmental monitoring makes use of the fact that polluted or stressed communities are characterized by a change in their species abundances which often switch from being log normally distributed to following a geometric series.

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Diversity measures are more useful in lake ecosystems which harbor a large variety of algal species in general and species diversity within genera. Therefore application of species richness indices is essential. Secondly it is necessary to apply species abundance models which describe the distribution of species abundance. The diversity of a community may therefore be described by referring to the model which provides the closest fit to the observed pattern of species abundance.

Lake Monitoring using Satellite Image based on Deformable Model

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Conservation and management of water resource involves source of water coverage information that are potentially useful to humans. By nature, this precious gift can be expanded or destroyed. To make best use of water and its natural resource, we need good factual knowledge of the water and its coverage. Accurate knowledge on water-coverage is very vital for planning efficient use of water. Further this information can be used to audit water usage, in the context of urban/rural planning. One of the main sources which can capture the temporal nature of the knowledge is the satellite image. In this paper, we present a satellite image processing framework for precise assessment of water coverage mapping using deformable model for the problem of lake monitoring for an urban region. The deformation method is used to extract boundaries and to determine the extent of water covered region. The performance of the various deformation algorithms has been evaluated.

Nygaard's Algal Index in Determination of Trophic State of Lake Ecosystem

M.K. Mahesh and S. P. Hosmani

Nygaard proposed five indices to evaluate organic pollution in lake waters. They include Cyanophycean or Myxophycean index, Chlorophycean index, Bacillariophycean index, Euglenophycean index and a compound quotient. A large, but slightly polluted lake; Hadhinaru Lake was selected for the present study for a period of one year. Standard methods were used for the collection, preservation and enumeration of algae which were identified and classified into five groups. Nygaard's indices were calculated and the trophic state of the lake was determined. Myxophycean index showed that the lake tends from oligotrophic to eutrophic nature. Chlorophycean index indicates that the lake water is eutrophic. Euglenophycean index shows that the lake water is mainly oligotrophic (indicating less organic pollution) but later tends to be eutrophic. The compound quotient indicates that the lake water always tends to

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become eutrophic. Bacillariophycean index cannot be calculated as the lake did not show the presence of centric diatoms. Nygaard's index is simple and easy to calculate and can be used as an important tool in determining the trophic state of Lake Ecosystem.

Forest fragmentation in a Micro watershed of West Himalaya

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Forest fragmentation is the process whereby a large, continuous area of forest is either reduced in spatial extent or divided into two or more fragments. The decline in the size of the forest and the increasing isolation between the two remnant patches of the forest is the major cause of declining biodiversity. Fragmentation was studied in relation to land use type. The pattern and extent of fragmentation were quantified using established indices for a micro watershed in the catchment basin of river Sutlej, Shimla district, Himachal Pradesh. Anthropogenic influences in fragmentation of forests are evident from the significant correlation between the extent of agriculture and barren area with most of fragmentation indices.

SESSION VIII: *URBANISATION: IMPACTS ON ECOSYSTEMS*

Impacts of Urbanization on wetlands:

A Case Study – Tumkuru Amanikere

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Wetlands are the most productive and biologically diverse but very fragile ecosystems. They are vulnerable to even small changes in their biotic and abiotic factors. For the past several decades, the wetlands have been under stress due to urbanization and many anthropogenic activities in developing cities and towns, such as Tumkuru. In this study, Tumkuru Amanikere has been selected as a case study, mainly to enquire into its ecological health and develop a strategy to protect it from threats due to urbanization. The visual observation, information collected from the localities and previous data proved the impacts of urbanization on this man-made wetland. Increase in dumping of untreated sewage and solid wastes, industrial effluents into the lake have caused the degradation. It is accompanied by increase in the infestation of water hyacinth, turbidity of water, the amount of lead (5.51 ± 0.92 ppm), evapotranspiration and BOD level. Loss of some local species fishes, destruction of nullahs which feed the lake, encroachment, loss of habitat of endangered green pond frog, fluctuation in the number of visiting birds, are few impacts of urbanization on the ecology of lake. Lack of socio-cultural relationship between the local communities and the wetland was also observed. It requires immediate implementation of wetlands conservation laws and some wetland development projects.

The Impact of Urbanization on Tumkur Ammanikere Lake

-A Case Study

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Most of our water resources are gradually becoming polluted due to addition of foreign materials from the surroundings. These include organic matter of plant and animal origin, land surface washing, and industrial and sewage effluents. Rapid urbanization and industrialization

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with improper environmental planning often lead to discharge of industrial and sewage effluents into the lakes. The aim of the study is to assess the lake water quality, surrounding area groundwater quality, extent of heavy metal contamination of water and soil quality in the watershed area of the lake. The present work is also aimed at assessing the water quality index (WQI) for the groundwater around Ammanikere Lake. The DO of the Ammanikere Lake water ranges from 1.4-7.5 mg/l. The lake water BOD ranges from 12-54 mg/l. Water quality index (WQI) values ranges from 75 to 171 in the command area and 85 to 191 in the catchment area. Samples of water have been analysed for five heavy metals, viz. Cu, Cd, Cr, Pb and Zn. Results show the presence of some of the heavy metals in the water. Soil samples have been analysed for Fe, Mn, Cu and Zn. An attempt is made to study the effects of urbanization on Tumkur Ammanikere Lake. The study also suggests method/techniques to counter the effects of urbanization to some extent.

Urban Heat Island in a Coastal City Interlaced by Wetlands

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The Urban Heat Island (UHI) in Kochi, a fast growing urban region in coastal Kerala, was investigated. Western parts of the city adjoining the coast are interlaced by a network of canals and wetlands which are part of the Vembanad Lake system. The UHI during summer and winter periods were recorded through mobile traverses as well as stationary continuous recording instruments located at select locations within the region. The intensity of the heat island during summer was 2.2 K and during winter was 2.8 K. It is observed that the intensity of the UHI here is moderate compared to that observed in other cities in the region. It is inferred that the wetlands is controlling the intensity of the Urban Heat Island here. The heating and cooling rates in different locations within the region were also computed. The results are reported.

Baseline Study On An Eco-Restoration Process Of A Hyper-Eutrophic Urban Water Body

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In 1981 the Government of India signed the Ramsar Convention and as a consequence 25 lakes and wetlands were identified. Two National programmes were launched by the Indian government namely, “The National Lake Conservation Plan” (1994) and “The National Wetland Conservation Programme” (1995) to rejuvenate the degraded lakes and wetlands throughout the country. Currently the new “Wetland (Conservation and Management) rules 2008” is on the 22 – 24 December 2008, IISc, Bangalore

way drafted by the Ministry of Environment and Forests, targeting to protect surface water bodies like ponds and wetlands. Though the Indian Government puts lot of emphasis on the restoration of lakes and wetlands only few scientific information is available. Studies were conducted at Chilika lake in Orrisa, Sambhar lake in Rajasthan and other location but most of them dealing with large scale water bodies and the programmes are not designed to understand the restoration process from scientific angle. There is need for more intensive studies based on the biochemical restoration processes, as there are nutrient fluxes, DO loadings in the epilimnion, metalimnion and hypolimnion, and comprehensive pollution management. A hyper-eutrophic pond was selected in Chennai city to conduct intensive studies on the impact of various restoration methods on the water body. For that purpose bathymetric study, sludge depth analysis, vertical DO profiling, physico-chemical and microbiological analysis was conducted. The results reveal that the removal of nutrient concentration from the pond is achieved by subsequent removal of water cabbages, which resulted in a temporary reduction of 71% and 69% of nitrate and phosphate respectively. A combine re-aeration and filtration system was deployed and observed over a period of 22 days. The use of re-aeration caused a reduction of nutrients and organic matter in the pond, whereas filtration was used to remove predominantly mineralized organic phosphate and nitrogen from the pond by filtering the algal biomass. The removal of biomass from the water body resulted only in a meager reduction of phosphate and nitrogen of 2% and 16% respectively. However, the average saturation level of oxygen in the total pond increased from 30% to 45%. In addition to filtration and aeration EM enhanced biological sand filtration is used and yet under investigation.

Characterization of leachate and ground water samples of a municipal solid waste Dumping site of Bangalore city, Karnataka

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With increase in the global population and the rising demand for food and other essentials there has been a rise in the amount of waste being generated daily by each house hold. If the waste is not managed properly it can pollute the water supply along the whole length of the water course including the air near by. Infections and diseases can spread from dumping sites into general population.

The present study deals with the analysis and estimation of water quality of Haralukuntae Lake of somasundarapalya village of Bangalore city which is in the vicinity of the dumping site, Karnataka compost developing corporation (KCDC). The parameters analysed were above the permissible limits when compared to the Standards of disposal of treated leachates by Maximum Permissible limit (MPL) by Bureau of Indian standards (BIS) and Indian council for medical research (ICMR) for surface water, for leachate samples and tolerance level prescribed

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by BIS and ICMR for ground water samples. Total hardness and total alkalinity was more than twice the above desirable level and TDS was four times above MPL for ground water samples.

Historical Evolution of Tank System in Bangalore City

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Many of the present cities previously emerged as settlements, along water bodies. The relation between settlements and water is unique and important. The paradigm here is water is considered a source, which sustains life, nurtures occupations and supports religious beliefs.

Presently, there is shift in paradigm, with urbanization & globalization,

- The ill-effects of negating water have caused urban ecological imbalance, pollution, unhygienic conditions, floods during rains.....
- The trends of development and increased land demands have caused encroachment of tank beds, sewage disposal into tanks and nalas.....

The main contents of the study would include the historically present system of tanks.....

- Arkavathi/ Pinakini River Basin.
- Water Network System in Bangalore City.
- Planning principles and land use allocation, considering topography.

This paper highlights the water network as a structuring element, which also gives Bangalore an identity. An understanding of tank system would help us conserve this unique asset of our city.

Impact of Urbanization on Surface, Sub-Surface and Ground Water Quality (A case study for Hebbagoidi village, Anekal tauk, Bangalore urban district)

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In the holy books of the world religions, water features as a source of life. There would be no life on earth without water. In many areas, water supply for industrial, domestic and agricultural uses are dependent on water. Of late for agricultural development, more and more ground water is exploited, particularly in the arid and semi-arid regions. Hebbagodi village and its surroundings in Anekal taluk, Bangalore urban district is taken up for studies on the impact of urbanization and the resulting effects on surface water and ground water. The village has no basic infrastructure facilities as such and it is surrounded by Bommasandra industrial area with growing residential colonies and apartments. For surface water quality investigation, water samples of two lakes (kere) viz., Hebbagodi lake and Kammasandra lake are considered for physical and chemical analysis. Also, water samples taken from shallow wells and deep wells are subjected to analyses. From the results of analyses, it is observed that the ion concentrations are above the permissible values and thus they are unfit for use, let alone potability.

The paper discusses possible preventive measures to be taken up for protecting of water quality of from different sources against their further deterioration. Some of the tasks proposed for abatement of contamination of water are discussed. Further, cost effective treatment methods for water purification are suggested so that water can be used for potable purposes.

SESSION IX: *Law, Economic valuation and Policy*

Economic Valuation of Wetlands: Methods and Empirical Evidence

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“Wetlands” are a group of ecosystems, which include lakes, estuaries, swamps, bogs, marshes, mires and fens. Wetland ecosystems account for 6 – 8.6 percent of the world land surface and are found from tropics to tundra except Antarctica. Sixty percent of the wetland area is in tropical as well as sub tropical regions. The values of wetlands are in general classified as use values and non use values. Use values are the direct and indirect tangible benefits which can be extracted or available to the people who are depended on the wetland. This paper deals with the methods of assessing the use and non - use values of wetlands with an empirical example of the case of Ashtamudi estuary in Kerala.

The Legal Aspects of Wetlands Conservation in India

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In the recent years, there has been increasing concern over continuing degradation of wetlands and in particular, rivers and lakes. Almost all recent constitutions of the world establish a general obligation on the part of the State and a duty for citizens to protect the environment. Legal instruments at international, national and local level, different approaches in wetland management regulatory and non-regulatory mechanisms, interdisciplinary study's etc., are the important tools which facilitate the wetland restoration efforts. This article is to focus on the existing Indian laws and how far our legal mechanisms support the nature conservation especially on wetlands habitat, and implementation of the Ramsar obligations. The Wetland conservation policy and recent regulatory framework on wetlands conservation in India, role played by the judiciary are the central issues being addressed. An over view of this subject reflects the present Indian scenario and target to be reached in the days to come.

Valuation Of Lake Biodiversity –Essential To Control Water Pollution In Lakes

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The valuation of environmental resources and biodiversity as a whole has become an increasingly necessary topic of research as our understanding of the importance and benefits of the proper functioning of the environment increases. This paper is an effort towards the socioeconomic importance of Lake Biodiversity and the importance of economic valuation to conserve the same. Due to high rate of industrialization and also lack of awareness of the people about the relevance of conserving wetlands for sustainable development, more than 50% of the lakes all over the world have extinct during the previous century. Many are dying slowly. There is an urgency to protect and conserve them irrespective of the economic status of the country. Economic valuation is highly recommended as a means to achieve it.

This paper tries to explain this point with comparative case study of two lakes in Mysore District by applying Contingent Valuation Method

India's National Water Policy (2002) in the Light of Climate Change

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The broad consensus of the scientific community is that climate change will adversely affect water resources availability in many regions. India, being a developing country, is all the more vulnerable to the threats imposed by the same. To reduce the vulnerability of the water resources to the ill-effects of climate change, alongside limiting the negative factors influencing the climate, it is also imperative to adapt to the changing climate and to attempt towards mitigation. An attempt was made to analyse the National Water Policy, 2002 (NWP) in the light of climate change. A literature review and a thorough study of the IPCC Reports of 2001 and 2007 and the NWP, 2002 revealed some gaps in the latter. This policy did not even cursorily mention climate change as an additional factor of uncertainty faced by the water resource managers. A clause by clause analysis brought out some more inadequacies. Finally, some suggestions were laid down which maybe helpful in drawing up the next such policy or while going for amendments in the existing one.

LAKE ECOSYSTEMS IN INDIA: LAW, POLICY AND PRACTICE

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It would seem rational to expect a well coordinated approach to the management of lake ecosystems in India where the various arms of the state act in a synchronized manner. But this is not as simple as it sounds, for, under the Constitution of India, the power to legislate under with respect to water resources is given to both the centre and the states under Entry 56, List I of Seventh Schedule and Entry 17, List II of Seventh Schedule respectively. This means that there is no one single authority that is responsible for the lake ecosystems in India. In practice, there is often a great deal of conflict between the attitudes that the various branches of the State show towards the management of lake ecosystems and this has meant that there is no one single unified approach to the issue. And interestingly enough there is even conflict on the question of whether such a single unified approach is desirable? Shouldn't there be different approaches for different lakes, such that the unique circumstances of each different lake can be catered to? This paper examines how this 'dichotomy' is not really a problem at all and looks at how the existing law, policy and practices interact with each other and affect each other, while furthering the argument that no amount of law and policy making will be effective in the absence of a sincere effort to involve the members of the general public in the effort to conserve India's lake ecosystems by educating them about the importance of the same.

Environmental Awareness: A Case Study of Migrant Workers in Ankleshwar (Gujarat)

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Conservation of Environment through Sustainable developmental practices is essential to secure our future. The rapid unplanned urbanization has lead to indiscriminate exploitation of Natural resources. This is leading to imbalances at the local and global levels. To actively participate in conservational practices, one needs to know and understand the current Environmental concerns. In this context, the paper seeks to explore the influence of Environmental Awareness on the Perception of Environmental Risk. Also, it tries to understand Risk Communication between Government agencies and different stakeholders. This study was conducted from May-July 2008 in a community of Migrant workers living in Sanjali village of Ankleshwar. They all depend on Industries for their livelihood. Their surroundings and the level of awareness influence Risk Perception. It has been found that respondents with better

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understanding of Environmental concerns are able to identify potential threats and perceive them as risk. The study indicates that Environmental Awareness influences Perception of Environmental Risk.

POSTERS SESSION

**Eco-chemical Characterizations of Surface Water Bodies in and around
Mining Areas of Western Part of Kachchh, Gujarat**

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Mining and processing of minerals is likely to cause severe impacts on the surface water resources both directly and indirectly. We undertook an investigation to evaluate the quality of 16 surface water bodies in and around lignite and limestone mine sites in the western part of the Kachchh district in Gujarat state. The study was undertaken during April - June 2008 covering the pre-monsoon season of the year. Water bodies were selected based on their location with respect to their radial distance from the center of the mine site, i.e. within mine site, 0-5 km, 5-10 and > 10km in order to understand the spatial variation of several water quality variables.

48 water samples were characterized with regard to basic parameters, alkali and alkaline earth metals, and dissolved heavy metals. Most of the variables studied showed significant spatial heterogeneity (General Linear Model, ANOVA, $P < 0.05$). pH ranged from 7.3 to 9.1 which indicate all the water samples are alkaline in nature. EC and TDS ranged from 521.2 to 18,859 $\mu\text{S}/\text{cm}$ and 32 to 11,580 mg/l, respectively. Suitability of surface water for irrigation was evaluated based on sodium adsorption ratio (SAR), residual sodium carbonate (RSC), and the values ranged from 0.99 to 38.66 and -149.42 to 1.41, respectively. All the heavy metals Fe, Mn, Cu, Pb, Zn, Ni, Cd and Co displayed clear spatial gradient and was attributed to the varied nature and amount of colloidal matter in the waters at these sites. Most of the heavy metals were negatively correlated with total hardness and bicarbonate concentration. Of all the metals, Cu was found in low level; high hardness and bicarbonate content in water (60 mg/l to 6400 mg/l and 20.3 to 198.8 mg/lit, respectively) was probably the reason for reduced level of dissolved heavy metals especially Cu; suggesting possible complexation and strong association with the organic films on Fe and Mn colloids.

The Comparative Study Of The Waterfowl Communities With Reference To Narmada Inundation

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Ecologically, freshwater wetlands are patchy ecosystems within the terrestrial landscape. In recent years many smaller to medium sized water bodies are inundated with water from larger water bodies constructed for generation of hydro power. The shallow waters of these water bodies form wetlands that support wide range and densities of waterfowl species. In the present study importance of such inundation with reference to water birds is considered.

Two irrigation reservoirs first the Timbi irrigation reservoir, inundated with Narmada water and the second, the Jawala irrigation reservoir that solely depends on the rain water were selected for the present study. The birds observed for two years in the two reservoirs were categorized into 4 groups depending on their feeding habits. These are Group I: short distance flushing birds like Moorhens, Coot and Jacanas. The Group II: the diving and the dabbling ducks. Group III: the wading birds and IV: the Kingfishers and Terns. A significant difference ($P < 0.05$) in the density and the species richness has been noted between the two irrigation reservoirs. The diversity index (H') and the Evenness (E) showed highly significant differences ($P < 0.0001$). Further, the Group wise seasonal and total comparison showed varying levels of differences when the waterfowl population attributes like species richness, density and diversity and evenness are considered.

From the data collected it can be said that apart from the differences in the area, the connectivity of the reservoir with a larger river like Narmada has made prominent change in the species richness and the density of the birds at reservoir especially to the resident species. If the input of water is managed, the maintenance of hydrologic condition can bring about significant changes in the biodiversity supported by wetlands.

Limnological survey of Sama, the urban pond of Vadodara, Gujarat

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Limnological study is one of the most important approach to study the functional aspects of the fresh water bodies. The urban pond is influenced by several extrinsic factors which may

alter the structural and functional components of such ecosystem. The present study deals with the seasonal variation in the water quality of the urban pond at vadodara city (Gujarat) during Nov-2007 to Oct-2008. The samples were collected from three different sites, having varied external influences. Various physico-chemical parameters like Ph,temp,acidity,alkalinity,hardness,chloride,salinity,dissolved oxygen,phosphate,silicate,nitrate etc.. were analyzed. Significant seasonal variation was observed during the study for various parameters which was compared for different sites. The results were correlated to external influences and human interference.

Population of Birds in and Around Three Urban Ponds With Reference To Different Vegetation Cover

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Vadodara is one of the metro cities of Gujarat state. It has several ponds surrounded by different types of habitats like vegetation and concrete structures. About 60 ponds of the Gaekwad regime a century ago has come down to 30 due to draining of waterbody. Some of these pond support good diversity of the avifauna. Birds are one of the useful biological indicators of health of an ecosystem that respond quickly to secondary changes resulting from primary causes created by any change in the habitat. They are simple and inexpensive to monitor too.

Present study documents such hard and adaptable species of birds which have either adapted to or not yet left the urban area of Vadodara city. Birds were surveyed in and around 3 different ponds Lalbaug pond (LP- A pond with high level of eutrophication and also surrounded by garden and residential areas), Gotri Pond (GP – A pond with minimum eutrophication and totally surrounded by human habitation) and Harni pond (HP- with submergent and emergent vegetation as well as with pressure of expanding human habitation). All the three ponds were visited once in a month from October 2005 to September 2007. 36 species of terrestrial and 18 species of water birds were observed at LP while, 29 species of terrestrial, 18 species of water birds at GP and 16 species of terrestrial and 27 species of water birds were observed at HP. Species diversity of terrestrial birds was high at LP because of garden whereas density of terrestrial urban birds like pigeons, parakeets, crows, mynas and kites were high at GP and HP. HP support more species of water birds because of submergent and emergent vegetation. Good vegetation as well as good quality of water supports various types of birds in urban areas whereas hard and adaptable species occupy the disturbed areas in high densities. The influence of gardens, human habitation and emergent and submergent vegetation on density and diversity of terrestrial as well as water birds is discussed with the help of species richness and density as well as species diversity and Evenness indices. The data is statistically analyzed.

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Faunal mortality on roads during an annual festival in Kalakad-Mundanthurai tiger reserve, Southern western Ghats, India

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We sampled the road section passing through the Kalakad Mundanthurai tiger reserve (KMTR), Southern western Ghats for mortality of organisms on roads in order to evaluate the effect of the increased vehicular movement during the annual Sorimuthian festival which attracts about 5 lakh pilgrims over 10 days. A total of 50 species belonging to 9 classes were recorded among the organisms killed on the road. Frogs and millipedes were found to be killed more than any other organisms the road mortalities increased during the festival when there was higher vehicular density. There was a substantial increase in the road mortality of nocturnal species when the vehicular movement was allowed in the night during the festival. There is an 87% increase in the occurrence of road mortalities before and during the festival and this long term impact on the fauna due to the Sorimuthian pilgrimage is significant considering the high diversity of organisms in the forests.

Role of exotic fishes on the food web ecology of Kelavarapalli reservoir ecosystem

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A mass/balanced model of Kelavarapalli reservoir, a fresh water ecosystem in Tamil Nadu, India was constructed to quantitatively describe the possible impact of fish introductions in this ecosystem. This study is considered as an initial step in summarizing ecological and biological information under a coherent framework on this ecosystem.

14 compartments were considered which included three exotic fishes, African cat fish, Nile tilapia and Mozambique tilapia. Nile tilapia is the most abundant fish in the commercial catch. The trophic impact routine shows that an increase in the abundance in the African cat fish would negatively impact almost all fish groups such as Indian major carps, other cichlids, other cat fishes and Tilapines. The other exotic fish Mozambique tilapia adversely affects the other cat fishes. The most interesting observation in this study is that exotic Nile tilapia does not negatively impact any of the fish groups. In fact it shows positive impact on Indian major carps. The direct and indirect effects of predation between system components (i.e. fish, invertebrates, phytoplankton and detritus) are quantitatively described and the possible influence and role in the ecosystems functioning of introduced fish species were evaluated.

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Evolution of trophic relationships in a productive reservoir in Tamil Nadu

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An ecopath model of a productive reservoir in Hosur, Krishnagiri district of Tamil nadu, India was constructed using ecopath software. Thirteen living functional groups and the non living group, detritus were used in the present analysis to estimate the trophic relationship and energy flow. Low values of ecotrophic efficiency were observed for phytoplankton (0.276) and zooplankton (0.146). this shows that this groups are underexploited. The tilapine fishes *Oreochromis niloticus* and *O.mozambicus* showed low EE values of 0.042 and 0.01 respectively suggesting a very limited exploitation and predation in the reservoir. The maximum EE value is recorded for other catfishes (0.903) which show that these fish are heavily exploited. The system network was mapped into a linear foodchain using network analysis. The parameters and indices developed in this model for network analysis were selected to describe trophodynamics in the level of development and maturity of the tropical reservoir ecosystem. This trophic reservoir ecosystem is in the development phase. The high values of ascendancy (35.9%) in this reservoir seems related to low levels of maturity in the system. Finn's cycling index was 3.04% of total system throughput which also indicate that the system has not attained maturity.



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