

## **LAKE 2004--International Conference on Conservation, Restoration and Management of Lakes and Coastal Wetlands Bhubaneswar, Orissa**

Inaugurating the conference, Mr. Navin Patnaik, Chief Minister of Orissa said India has a long densely populated coastline extending over 7,500 km. Orissa having an approximate coastal area of 15.571 million hectares is bestowed with six major estuaries, Bhitarkanika sanctuary (which is India's second largest mangrove forest), and above all Chilika, Asia's largest brackish water coastal lagoon.

Dr. Pratap Kumar Mohanty spoke on this occasion emphasizing that Lake 2004 is a biennial event and it was started by the Karnataka Environment Research Foundation and the Centre for Ecological Sciences, Indian Institute of Science, Bangalore in 2000. The basic idea was to bring out the trends in aquatic ecosystem conservation, restoration and management including the hydrological, biophysical, peoples participation and the role of non governmental, educational and the governmental organizations and future research needs. Lake 2002, the second conference in the series, was held at the India Institute of Sciences, Bangalore. Lake 2004 was the third in the series and was organized in Bhubaneswar, Orissa with its theme as "Conservation, Restoration and Management of Lakes and Coastal Wetlands".

T V Ramachandra, Convener of Lake symposium in his keynote address emphasized the need for conserving aquatic ecosystems. He also elaborated on the action plans to be implemented for sustainable management of Ramsar sites – wetlands in India.

Prof. Rajasekara Murthy spoke on the worldwide fresh water demand. It is constantly being pushed to new heights by industrialization, irrigated agriculture, massive urbanization, ever-rising standards of living and growing populations. More than 500 million people (about 8%) face serious fresh water shortages. By 2025 this will grow to about 2.8 billion (about 35% of the projected population). Integrated Water Resources Management (IWRM) must be implemented at the river basin or watershed-scale, with the integration of land and water, upstream and downstream, ground and surface water, and coastal resources. It is important to take an inter-sectoral approach to planning and decision.

There were about ninety oral presentations and 38 poster presentations under various themes and these were presented in 12 technical sessions. Besides, in two special sessions, school and college students made scientific and poster presentations on the Chilika Lake ecosystem. Student's presentations highlighted the role of wetlands in sustaining life and maintaining an ecological balance. Wetlands protection must be enforced by strict environmental laws as well as community based participation. Students participation in Lake 2004 was sponsored by the Commonwealth of Learning in Vancouver, Canada.



From left: Dr. Pratap Mohanty, Dr. Rajasekara Murthy, Mr. Naveen Patanayak, Chief Minister of Orissa, Dr. Swadhin Pattanayak

### CHILIKA LAKE: Restoration and Conservation of Chilika Lagoon:

Chilika lagoon, situated along the east coast of India, is a unique wetland and a designated Ramsar site. It is an assemblage of marine brackish and fresh water ecosystem with amazing biodiversity that shelters a number of endangered species. The highly productive lagoon ecosystem with its rich fishery resources sustains the livelihood of more than 0.2 million fisher folk and 0.8 million people who live in the catchment of the lagoon. In 1973 the area covered by weed was 20 sq km and in 2003 the weed-infested region was about 427 sq km. There are about 12 fish catching areas in Chilika. Chilika is the largest brackish water lake. The length of the Chilika lagoon is 64 km, breadth is 20 km, average water spread area 1065 sq km, and the depth is 0.38 mts. There has been a proliferation of invasive species and loss of biodiversity. Chilika is a complex ecosystem with multiple stakeholders with 0.2 million people being dependant. Coastal seas, bays, estuaries, backwater lagoons, river, lakes, reservoir, large beds and oxbows lakes have cage fishing. Legislation was brought in, to curb illegal shrimp culture. Chilika receives fresh water from Mahanadhi, western catchment.



The Ramsar Bureau added it to the list of the Motreux record (threatened list) in 1993 due to the changes in its ecological character. The lagoon has been encountering problems of siltation, choking of the inlet, as well as the outlet channel connecting the sea, progressive shifting of the mouth away from the lagoon proper, and consequent decreases in the salinity gradient, proliferation of invasive species due to the fall in the salinity, shrinkage of areas, loss of biodiversity, depletion of the fishery resources, water logging in the peripheral agricultural lands, and an overall decline in the productivity adversely affecting the livelihood of the community.

An approach on a micro watershed basis, a strong outreach programme in collaboration with the local community and the NGOs, development of a visitor center, a research center on wetland management are components of the restoration plan.

Chilika was removed from the Montreux record by the Ramsar Bureau with effect from November 11<sup>th</sup>, 2003 for the improvement of the ecosystem of the lagoon after the restoration measures taken by the CDA. The prestigious Ramsar Wetland Award and the Indira Gandhi Paryavaran Purashkar are also conferred on CDA for the impressive way in which the restoration model of Chilika has global relevance.

Chilika is the largest lagoon along the east coast of India. It is one of the hotspots of biodiversity and shelters a number of endangered species listed in the IUCN red list of threatened species, and also is a designated Ramsar site. It is an avian grandeur and the wintering ground for more than one million migratory birds. The

highly productive lagoon ecosystem with its rich fishery resources sustains the livelihood of more than 0.15 million fisher folk who live in and around the lagoon.

Problems identified by the Chilika Development Authority were siltation, major morphological changes in the inner and outer channels, a decrease in salinity, declining fish stocks, proliferation of fresh water invasive species, hydrological changes leading to water logging in the peripheral crop land, and unauthorized shrimp and prawn culture.

The hydrological intervention for the restoration of the lagoon has resulted in a considerable improvement of its fishery resources, water quality and a positive impact on the biodiversity of the lagoon. This has significantly contributed towards the increase in the per capita income of the community who depend on the lagoon for their livelihood.

## **Coastal Wetlands**

Coastal wetlands are special types of wetlands that are influenced by the fluctuating water levels of the lake. These are critically important features that act as water purifiers, fish spawning areas, and feeding grounds and habitat for many animal species. Wetlands are an interface between land and water environments, and are areas that are permanently or temporarily submerged or water saturated, such that the vegetation growing within them is adapted to wet soil conditions. The length of time the water is retained in the wetland, and the depth of the water within the wetland, are key influences on the amount and variety of vegetation, as well as their distribution and ecological diversity. Wetlands are areas lying along the banks of rivers, lakes and the coastal regions. They are life-supporting providing fish, forest products, water, flood control, erosion buffering, a plant gene pool, wildlife, recreation, and tourism area. Large areas here have been converted to agricultural land or there has been widespread overgrazing. Removal of sand, gravel and other material from the beds of rivers and lakes has not only caused destruction to the wetlands but has led to sedimentation, which has affected other areas.

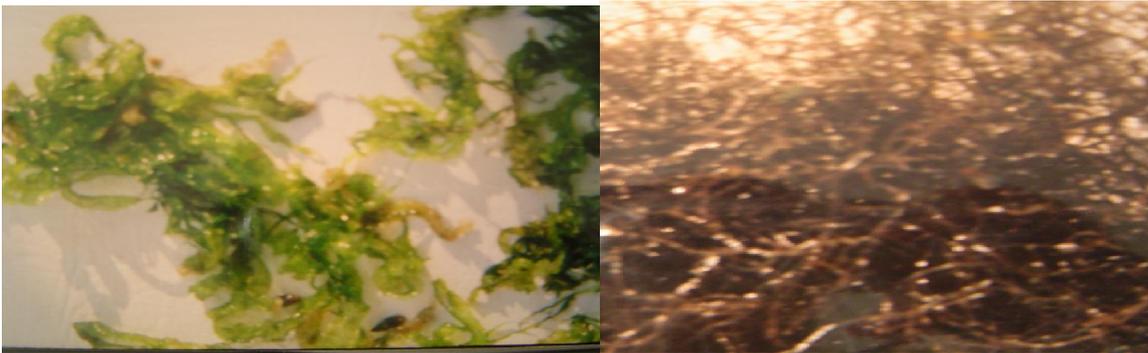
A number of factors have been responsible for the depletion of wetland areas, mainly the mangrove forests along the coasts of India. Intensive aquaculture development, deforestation, pollution from tankers, domestic waste, agricultural run off and industrial effluents are some of the factors. Most of the surviving mangroves are now confined to West Bengal and the inlands of the Bay of Bengal.

## **Cultivation of Seaweeds at Chilika Lake**

Dr. Dinabandhu Sahoo spoke on the importance of seaweeds as bioresources to the lake. Seaweeds are important as food for human beings, feed for animals, fertilizers for plants and a source of various chemicals.

More recently seaweeds are gaining momentum as a new experimental system for biological research and an integral part of an integrated aquaculture system. We all use seaweeds products in our day to day life in some way or other. For example, some seaweeds polysaccharides are used in toothpastes, soaps, shampoos, cosmetics, milk, ice creams, meats, processed foods, air fresheners, and many other items. In many oriental countries like Japan, China, and Korea, etc., seaweeds are a staple part of the diet. Thus seaweeds are widely used throughout the world due to their wide applications. Seaweeds like Gracilaria and Gelidium seen inside the waters of Chilika Lake, Orissa. One hectare produces about 10,000 kg of seaweed and these are edible.

Agar is widely used in paper manufacturing, culture media, packaging material, photography, the leather industry, plywood manufacturing, preservation of foodstuffs, the dairy industry, the cosmetics industry, and the pharmaceutical industry. Carregeenan is employed in the food industry. Its value is in the manufacture of sausages, corned beef, meat balls, ham, preparations of poultry and fish, chocolate, dessert gel, ice creams, juice concentrates, marmalades, and sardine sauce is well known. It is also used in the manufacture of non-food items like beer, air freshners, textiles, toothpastes, hair shampoos, sanitary napkins, tissue, culture media, fungicide, etc. The applications of alginates find a place in frozen foods, pastry fillings, syrups, bakery icing, dry mixes, meringues, frozen desserts, instant pudding, cooked pudding, chiffons, pie and pastry fillings, dessert gels, fabricated foods, salad dressings, meats and flavoured sauces. A model has been developed and successfully implemented in and around Chilika Lake where a person can earn Rs. 3,000-4,000 per month through seaweeds cultivation. If large-scale seaweeds cultivation is undertaken in and around the lake it will only be a Blue Revolution but will create thousands of jobs.



Seaweeds Gracilaria and Gelidium in Chilika Lake (Photograph by Rinku)

### **Study on growth and decay of water hyacinths in lakes – change in lake water quality and accumulation of organic matter (Dr. Rinku Verma and Dr. R. Venkataraman)**

Water hyacinths growing in the lakes absorbs the nutrients (phosphorous, nitrogen) being released in the lake controlling eutrophication. These plants sink to the bottom of the lakebed and decay affecting water quality. Theoretical and chemical estimation of nutrients extracted and the release of nutrients by water hyacinths

were carried out. The quality of TN, TP and BOD removed by water hyacinths in a lake was estimated. On an average, a 4-m<sup>2</sup> (2 m x 2 m) area had about 356 water hyacinth plants weighing about 56 kg.

These studies were applied to the lake. One hectare of water hyacinth plants removed 238.25 kg of BOD, 255.44 kg of TN, and 22 kg of TP from the lake in a period of 21 days. Death and decay of water hyacinth plants growing in a 1-hectare area would result in an increase in BOD by 245.53 kg and TP by 4.03 kg in 21 days. Chopped water hyacinth plants were not digested completely within the duration of the 3-week test.

An increased number of dead water hyacinth plants lead to debris in the lakebed. These organic deposits are subjected to anaerobic digestion releasing pollutants, accumulating year after year in a hypereutrophic lake resulting in a reduction in the depth of water and storage capacity of the lake and gradual transformation of the lake into a marshy wetland. To avoid this, planned biological suppression should be aided by mechanical harvesting of dead water hyacinth plants which will restore the lake over a period of years to a less trophic state thus improving the lake quality and the harvested water hyacinth plants can be put to commercial use.



Large size water hyacinth in waters of Cuttak, Orissa

## Status of Irrawaddy Dolphin in Chilika Lagoon, Orissa



The Irrawaddy dolphin is a small cetacean that inhabits coastal and estuarine waters of Asia, from the western Bay of Bengal east to the southern Philippines, and south to northern Australia. Adult dolphins range in length from 2 to 2.75 m.

There were seasonal and annual variations in the abundance and distribution of Irrawaddy dolphins in Chilika Lagoon from documented sighting surveys conducted from August 2002 to July 2004. The movements of dolphins appear to be affected by a variety of environmental factors. Depth, surface water temperature, water current, Beaufort, visibility and availability of prey play a vital role for sightings. Often dolphins are sighted in areas with the greatest benthic slope and depth, highlighting the influence of benthic landscape on their distribution and habitat use.

Unfortunately, the Chilika Irrawaddy dolphin population is far from secure. On one scale, the opening of the new Lagoon mouth has catalyzed a significant improvement in habitat conditions and an increase in fish stocks. However, a threat from boat activity - particularly tourist boats, in addition to accidental catch in fisheries gear - particularly crab nets and drifting/fixed gillnets, is obvious.

If dolphins are to remain in Chilika Lagoon, for the benefit of the ecosystem and communities involved in the dolphin watching industry, these threats must be mitigated immediately, before the population becomes so small that conservation activities are effectively futile.

Conservation of the Irrawady dolphin is necessary and captive breeding should be taken up as a challenge to protect these species found in India and Malaysia. The Government of India should look into this matter and come forward with remedial measures listed to save the dolphins of India's east coast.

## **Lake-2004: Recommendations**

- **ACTION ORIENTED CONSERVATION AND PROTECTION PLAN FOR CHILIKA LAKE**

- Declare Chilika Lake, with its watershed, the national heritage site and strict implementation of time bound conservation and restoration measures. Integrated water resource management of Chilika watershed and integrated coastal management.
- Interdisciplinary, intensive monitoring and modeling of hydrological, meteorological, limnological and coastal oceanographic studies be taken by CDA.
- Declare a buffer zone of wetlands as a protected area devoid of any developmental activities.
- Ecosystem approach with integrated holistic approaches in the management considering all biotic and abiotic components of the ecosystem, with its functional aspects to ensure sustainability.
- Establish a permanent laboratory with research facilities at wetlands site (with the sensors to characterize: biological, physical and chemical, hydrological, meteorological) and encourage local college and school students to carry out the dissertation work (part of the curriculum at degree and post graduate levels). Fully equipped live labs would help the younger generation to understand and learn the importance of the ecosystem.
- Capacity building - environment education by establishing eco-schools. Inclusion of field oriented environmental education in the school curriculum.
- Training of all stakeholders (at regular intervals - about wetlands importance, biotic and abiotic factors, sustainable management practice.....).
- Biological studies and regular stock assessment of important fauna (dolphin, shell fish, fin fish, etc.) needs to be undertaken for a better understanding and utilization of natural resources. Developing a biodiversity register involving schools and colleges for Chilika.
- Reconstitution of CDA involving all stakeholders - local people (who depend on the lake for their livelihood), academicians and researchers. Constitution of a task force involving local people for regular monitoring.

- Reduction of siltation: improvement in land cover in a phased manner with appropriate land use practices. Catchment treatment with the species locally preferred (or could meet the food, fodder and fuel requirement of the local population as well as fauna).
- Measures to protect coral reefs and other aquatic flora and fauna.
- Improvement in riparian vegetation based on local hydrology and native species.
- Protection of breeding grounds of fauna (fish, birds, etc.) - banning hunting, fishing in breeding area. (Captive breeding of Dolphins.)
- Pollution prevention (through an appropriate design of sewage treatment plant up to tertiary level, if possible).
- Ban on use of plastics and implementation of integrated solid waste management as per the guidelines of the national SWM committee (constituted as per the Supreme Court verdict).
- Implementation of best engineered wetlands: prevention of non point source pollution.
- Rehabilitation of the local population (with proper housing, drinking water, drainage and sanitation systems).
- Ban on encroachment (illegal occupants to be evicted).
- Ban on aquaculture (that is unsustainable from the ecosystem point of view).
- The constitution of cooperative societies involving all local fishermen and ban on over harvesting of fish resources (restriction on the size of the net, number of licenses, immediate removal of non local fishermen with unsustainable harvesting practices). Removal of contract system (middle men) and sharing of resources equitably by local people. Constitution of local self help groups.
- Prevention of oil spillage (motor boats, etc.).
- Restoration of mangroves ecosystems in the coastal belt to avert the impact of natural calamities.
- Inventory, mapping and monitoring of the coastal and marine biodiversity.
- Conservation of forests and restoration of natural forests (deforestation is the prime cause for declining water resources, etc.).
- Strict law enforcement to our waters for their preservation (life).

**Birds painted by school children of Bhubaneswar, Fishermen with fish catch - Chilika Lake**



**Irrawaddy dolphin painted by school children**



**(Poster presentation by school children. Photograph by Rinku.)**