



**Annual  
Report**  
2011-12  
2012-13



Annual Report 2011-12 . 2012-13  
© Chilika Development Authority  
(A Government of Odisha Agency)

Published by  
Chief Executive  
Chilika Development Authority  
C-11, BJB Nagar, Bhubaneswar 751 014

Design & Print  
ThirdEye Communications, Bhubaneswar  
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Naveen Patnaik  
Chief Minister, Odisha



ODISHA STATE

The Chilika Lake is one of the hot spots of biodiversity and the first Ramsar site of India designated in 1981. Chilika is the largest wintering ground of migratory birds in Asiatic subcontinent and home for the highly threatened Irrawaddy dolphin. The highly productive Lake ecosystem with rich fishery resources supports the livelihood of more than 0.2 million fishers.

The successful hydrological interventions in 2000 by the Chilika Development Authority led to the significant improvement of the lake ecosystem, enhanced fish landing immensely benefiting the fishers communities. The restoration model adopted by CDA is acclaimed globally. The lake's removal from Montreaux Record and the prestigious Ramsar wetland conservation award for successful restoration testify this. The Secretary General Ramsar Convention who recently visited Chilika had highly appreciated the management practices adopted by CDA.

Chilika Development Authority has been taking several steps to promote sustainable management of the Chilika Lake and its basin through active participation of the local communities. I appreciate the efforts of CDA to document these activities in the form of an annual report for wider dissemination and sharing of information to a wider audience.

I wish the publication a grand success.

A handwritten signature in blue ink, appearing to read 'N. Patnaik', with a horizontal line underneath it.

(Naveen Patnaik)



**Shri Bijayshree Routray**  
Minister  
Forest & Environment, Labour & ESI  
Odisha

Chilika, the eco-wonder, is a precious gift of nature to our State. The culture, history and traditions of Odisha are intricately linked with Chilika. Its rich bio-diversity and natural resources play an important role in the ecological and economic sustainability of the region. More than two lakhs fishers inhabiting in and around the lake derive their livelihood from the fishery resources of the lagoon.

The eco-restoration of the lake is reckoned as a role model for other wetland world over. The restoration approach adopted by Chilika Development Authority is emerging as most appropriate and successful wetland restoration model for coastal wetlands within the country as well as the region.

I am pleased to note that Chilika Development Authority has developed strategic partnership with the leading National and International scientific institutes in framing the strategic actions for ensuring ecological sustainability of the lake.

I am glad to know that Chilika Development Authority is bringing out this publication documenting the activities carried over the last two years for generating greater interest and awareness among the various users.

I wish this publication all success.

*Bijayshree Routray*  
(Bijayshree Routray)





Shri R.K. Sharma, IAS  
Principal Secretary to Government  
Forest & Environment Department

Chilika Lake is a hotspot of biodiversity. This shallow coastal wetland is highly productive and at the same time extremely environmentally sensitive. Fortunately the lake could be restored successfully due to strategic hydrological intervention by CDA. What is critical now is to closely monitor the lake ecosystem and mitigate the threat to the lake ecosystem adopting the Ramsar guidelines.

A long-term management plan for sustainable management of Chilika Lake based on the Ramsar guidelines is developed by CDA. To bridge the knowledge gap, a series of scientific studies is being carried out which will further strengthen the sustainable management of the Lake and its basin. To ensure transparent scientific communication to a wider audience “Ecosystem Health Report Card” for Chilika Lake has been developed by CDA in collaboration with Myrland University and NCSCM Chennai.

Chilika Development Authority has been taking several strategic actions to deal with the increasing pressure on the lake resources and its ecosystem.

I congratulate Chilika Development Authority and wish the publication all success.

A handwritten signature in blue ink that reads 'Raj K Sharma'. Below the signature, the name '(R.K. Sharma)' is printed in a standard black font.

(R.K. Sharma)



## Preface

The years 2011 & 2012 were remarkably happening years for Chilika Development Authority. The most significant event was the visit of Anada Tiega, the Secretary General, Ramsar Convention to Chilika Lake. The Secretary General during his four days visit went around the lake and met a cross section of people. He also met the Hon'ble Chief Minister and Hon'ble Minister Forest & Environment and expressed his satisfaction over the management practices adopted in Chilika in conformity with the Ramsar management principles. He also witnessed the release of the Management Plan for Chilika Lake based on the Ramsar guidelines by the Hon'ble Chief Minister.

The most significant achievement during the period of report has been the development of "Ecosystem Health Report Card" for Chilika Lake, first of its kind in Asia. This is developed in collaboration with Maryland University & NCSCM, Chennai. It is a transparent science communication in a simple format to reach a wider audience. The health report card is a quantitative assessment of lake health done based on; Water clarity, Dissolved oxygen, Chlorophyll-a, Total catch, Commercial fish species diversity, Bird count and richness, Dolphin abundance, Benthic faunal diversity & Phytoplankton diversity.

Another landmark have been the installation of the sensor mounted floating data buoys at 10 strategic locations for transmission of the water quality data on real-time basis at 15 minutes intervals to the CDA Laboratory at Chilika. The significant achievement during this period has been the up gradation of Wetlands Research & Training Center (WRTC) with the financial assistance from Integrated Coastal Zone Management Project, Odisha. The WRTC is upgraded to a state-of-the-art lab, equipped with all modern research facility for wetland research.

To bridge the knowledge gaps following five scientific studies were commissioned; (i) comprehensive studies on water bird of Chilika lake by Bombay Natural History Society (BNHS), (ii) Fishery Resources of Chilika, by CIFRI, (iii) Study on the Benthos and meiobenthos of Chilika Lake, by IISER, (iv) Study of microbes of Chilika Lake by KIIT School of Biotechnology & (v) Study of macrophytes of Chilika lake by RPRC. The outcome of the study would provide a wealth of knowledge essential for sustainable management and wise use of the resources of the Chilika Lake.

A new outreach programme "Rangers of Chilika" was launched in collaboration with the "Barefoot" a leading NGO from Puri. A world-class documentary on Chilika by renowned film maker Shekar Datatri was successfully completed.

While the report contains only a part of our achievements and aspirations, we hope you would appreciate the sincerity of our endeavour.

Dr. A. K. Pattnaik, IFS  
Chief Executive  
Chilika Development Authority



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# Chilika Development Authority





Chilika Development Authority(CDA) was constituted vide resolution No.20369/F&E dated 20.11.91 under the administrative control of the Forests & Environment Department, Government of Odisha. Accordingly, Chilika Development Authority was registered under Registration of Societies Act, 1860 vide Regd No. 19257/57/1991-92 dated 28.01.1992, with memorandum of Association and rules and regulations.

The basic mandate of CDA is restoration and sustainable management of Chilika Lake with all its genetic diversity. The broad objectives of Chilika Development Authority are;

- To protect the Lake eco-system with all its genetic diversity.
- To execute various multidimensional developmental activities either itself or through some other agency to enhance the economic condition of the community.
- To survey, plan and prepare the project proposal for integrated resource management for all-round development in and around the Lake.
- To co-operate and collaborate with other institutions of the States, National and International institutions for all-round development of the Lake.
- To establish management information system for the Lake.
- To promote long term multidisciplinary research, prepare environment status report and establish education centre for the Lake.

### **The Chilika Lake**

Chilika Lake is situated on the east coast of India and is situated between 19° 28' and 19° 54' North latitude and 85° 05' and 85° 38' East longitudes. It extends from Southwest corner of Puri and Khurda districts to the adjoining Ganjam District of Odisha State. It is one of the largest brackish water Lake in Asia with estuarine character. The water spread area of the Lake varies between 1165 and 906 sq.km during the monsoon and summer respectively. The Lake can be broadly divided into four ecological sectors based on salinity and depth: the southern sectors, central sectors, northern sectors and the outer channel. It is the largest wintering ground for migratory water-fowl on the Indian sub-continent. It is one of the hot spot of biodiversity, and habitats for some rare, vulnerable and endangered species listed in the IUCN Red List of threatened animals inhabit the Lake area for at least part of their life cycle. This list includes a number of rare, threatened and endangered species such as Irrawaddy dolphin and the Barakudia limbless skink. The Nalabana wildlife sanctuary is located within the Lake. The Lake is a highly productive ecosystem and the rich fishery resources support the livelihood of more than 2,00,000 fisher folk who live in and around the Lake.

The Nalabana island inside the Lake, spreads over an area of 15.53 sq.km., is notified as a Wildlife Sanctuary. This island is an abode of the avifauna and is an important wintering ground for host of migratory bird. The avifauna of Chilika is diverse and includes 225 species of birds belonging to 26 families. The migratory species are predominated by 22 species of Ducks and Geese, 52 species of Plovers and Sandpipers, 14 species of Gulls and Terns.

Based on its rich biodiversity and socio-economic importance, Chilika Lake was designated as a Ramsar Site since from 1981. It is also included in the list of Wetlands selected for intensive conservation and management by the Ministry of Environment and Forests, Government of India. Chilika has been subjected to constant pressures from both natural and anthropogenic factors. The management problems have been siltation, changes in salinity gradient, increase in invasive species, and aquaculture activities,

resulting in loss of productivity and biodiversity. The degradation of the Lake's ecosystem resulted in change of its ecological characters. Chilika was included in the *Montreux Record* (threatened list of Ramsar site) in 1993 by Ramsar secretariat due to change of its ecological characters. Chilika Development Authority (CDA) was created by the Govt. of Odisha with an objective to address the above management issues.

### The journey travelled so far.....

Concerned over the rapid decline of the Chilika Lake ecosystem, the Government of Odisha created the Chilika Development Authority (CDA) to undertake measures for protection of the ecosystem through scientific intervention and research, collaboration and networking. The Governing Body of this authority is chaired by the Chief Minister, which signifies the high priority accorded by the government to lake conservation. Secretaries from the key departments, members of Parliament & legislative assemblies; collectors of Puri, Khurda and Ganjam are members in the Governing Body. The Governing Body is entrusted with the task of general superintendence of the affairs of the Authority. The Executive Committee chaired by the Principal Secretary (Forests and Environment) is responsible for taking executive decisions pertaining to CDA. The Chief Executive of the authority is the member secretary of the governing body and the executive body. The Chief Executive, of the CDA is entrusted with implementation of various programmes and work plans, and management of the CDA Office.

**Hydrological intervention:** CDA initiated targeted studies to trace the root cause of the degradation of the Lake ecosystem. From the outcome of the hydrodynamics modelling, it emerged that the migration & choking of the inlet is triggering degradation of the wetland ecosystem, particularly decline in fish catch and invasion of freshwater weeds. CDA, after extensive local consultations and inputs from scientific studies, opened a new inlet on 23<sup>rd</sup> September 2000. This intervention had a tremendous positive impact on wetland ecology, leading to increase in salinity and tidal flux, flushing out of sediments, rejuvenation of biodiversity and most importantly rapid increase in fish, prawn and crab catch. The restoration has been carried out based on the principles of wise use and integrated management, and with a major emphasis on the participation of the local population and their shared decision-making, as well as capacity building. The restoration of Chilika Lake derives its uniqueness from the strong participation by local communities, linkage with various national and international institutions, and intensive monitoring and assessment systems.

**Community based management of the lake basin:** The drainage basin of the lake has been the logical starting point for lake management. The environmental flow assessment provided necessary clues regarding the significance of the freshwater flow from the drainage basin to maintain the ecological integrity of the lake. Further assessment revealed that land degradation in the drainage basin not only leads to enhanced silt flow into the lake but also causes poverty, due to low productivity. An innovative participatory micro-watershed management concept was adopted with a "sustainable rural livelihood" approach for holistic management of natural resources. The drainage basin management program has been conceived as a long-term participatory process. The objective of this concept has been to facilitate the community through empowerment to take decisions and build capacity to work collectively. The participation of local communities and stakeholders in planning and implementing management of natural resources and in sharing the responsibilities of decision-making is a key feature of this ecosystem approach.

The basic approach was to create an enabling environment, through capacity building of the community, community based organisations and NGOs at the outset, and a series of need-based training programmes to facilitate an integrated and holistic management of micro-watershed by the community. One of the

most successful initiatives has been a series of rainwater harvesting structures, which the local community design and install and maintain. They succeeded in recharging aquifers and transforming local ecosystems as well as their surrounding economies. The advantage of the system is that along with arresting rainwater; it improved the moisture regime in the field, particularly downstream and reduces the silt load in to the lake. After the rainwater harvesting structures had been constructed, the production of rain-fed paddy improved and there has been no crop failure due to an erratic rainfall. Now the intricate link between vegetation water and livelihood is more apparent to the local communities. The holistic management of natural resources at the micro-watershed level also facilitated conflict resolution. Notably, there have been increased earnings from land and non-land activities for the poor, reduced debt, and improved livelihood and food security leading to further poverty alleviation, reduced environmental degradation and reduction in the silt load into the lake. This has led to increase in overall forest cover, improvement in soil conditions, and rejuvenation of commons such as village ponds, grazing lands, and ultimately reduction in overall silt flow into Chilika.

**Awareness generation:** CDA has launched an intensive CEPA campaigns on values and functions of the wetland system, particularly amongst the villages in and around and school children. A visitor centre at Satapada serves as the hub of these activities. This centre is open to local communities and visiting tourist round the year providing information on the wetland through exhibits, dioramas and models. Telescopes are placed in the Visitor's Gallery for Dolphin and water bird watching. An education kit for school children has also been developed. Events as World Wetland Day and World Environment Day are celebrated each year within the local schools and community centres to promote awareness and seek participation of communities in wetland management. Newsletter 'Chilika' in English and 'Chilika Darpana' in Oriya published by CDA are important means of communicating programmes and policies to the stakeholders.

**Improving community infrastructure and livelihoods:** To improve connectivity among the island villages; a ferry service for people and vehicles was introduced between Satpada and Jahnikuda benefitting more than 70,000 people. This service drastically reduced the travel time between Berhampur and Puri. CDA has also strengthened fishing infrastructure through construction of landing centres and jetties. Woman SHG Groups have been organized and trained to undertake enterprises on production of dry fish and crab fattening.

**Building knowledgebase:** To support systematic management, an intensive hydrological and ecological monitoring programme has been put in place. These programmes are coordinated through the Wetland Research and Training Center constructed on the shorelines of Chilika in 2002. Equipped with state of the art facilities, the Center is also a node for national and international training programme for wetland managers. Over the years, CDA has also established collaborations with over fifty organizations of international and national repute to support scientific studies related to various dimensions.

#### Visible Impacts achieved so far....

- **Revival of lake ecology:** As a response to the hydrological intervention and restoration efforts within the lake basin, several positive changes in the lake system have taken place as indicated by the following:
  - ◆ Reappearance of 6 species of fish and in addition to this 43 fish, 4 prawn, 7 crabs and 2 Indian spiny lobsters have been the new record for the Lake.
  - ◆ Regularly supports 0.7-0.95 million waterbirds annually.

- ◆ Decrease in freshwater weeds *Eichhornia crassipes* (water hyacinth).
- ◆ Restoration of salinity gradient.
- ◆ An increase in tidal flux from 0.36m in 1999-2000 to 0.56m in 1999-2000 and 0.80m in 2006-07.
- ◆ Expansion of sea grass meadows and species diversity.
- ◆ Increase in population of Irrawaddy dolphin from 70 in 2003 to 145 in 2012. The species previously observed to be confined to the outer channel has spread its habitat use to southern and central sectors as well.
- **Recovery of livelihood resource base:** Building on recovery of ecosystem, the lake fisheries have revived significantly from 1,747 MT in 2000 to 14,228 MT in 2012. The tourist inflow to Chilika has also increased substantially from 0.2 million during 1994-2000 to 0.43 million during 2000-08. These have created significant opportunities for the communities to benefit from restoration.
- **Removal from Montreaux Record:** In 2001, a Ramsar Advisory Mission was carried out at the Chilika Lake Ramsar site, which concluded with the recommendation that the site should be removed from the Montreaux Record, provided that the management measures are continued and monitored. The case of Chilika Lake is a perfect example of how the listing of a site on the Montreaux Record can be used to promote measures to correct change in ecological character of a site, and also to improve the socio-economic conditions of the population living in and around the site.
- **Recognitions:** Restoration of Chilika has been recognized by Ramsar Convention's Wetland Conservation Award 2002 alongwith Evian Special Prize, in recognition of outstanding contribution for conservation and wise use of the wetlands with the active involvement of all stakeholders. The Indira Gandhi Paryavaran Puraskar was also conferred to the CDA.



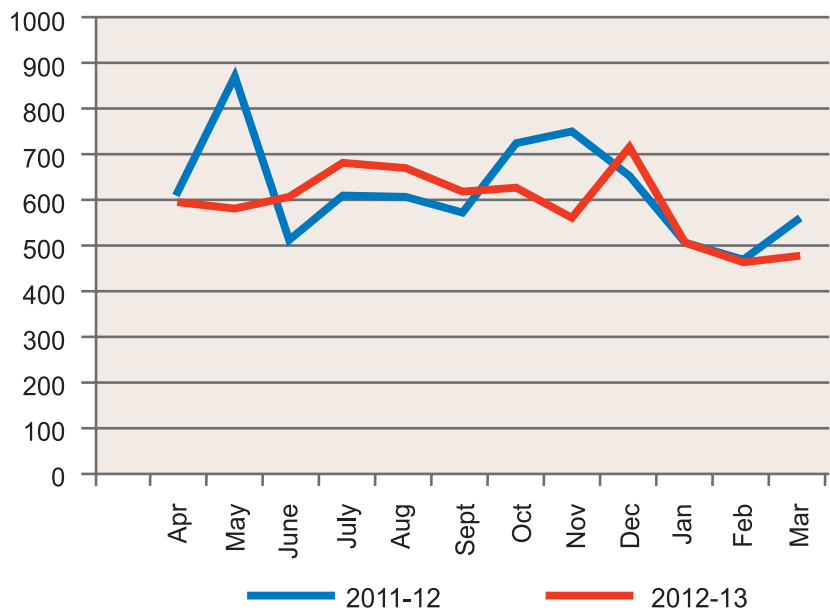
# Fishery Resources Development



Chilika Lake is one of the highly productive eco-systems in the country, Chilika Lake has been known for its fishery resources which support the livelihood of more than 0.2 million local fishers. After the hydrological intervention by CDA in 2000 by way of opening of a new inlet, the lake has witnessed spectacular enhancement in fisheries. There has been more than 6 folds increase in annual fish landings during the post restoration period in comparison to the pre-intervention period. Since opening of the new mouth, CDA has been monitoring the lake fishery from 27 fish landing centres through collection of landing data by adopting systematic sampling techniques. The fish landing data includes fish, prawn and crab components which are meticulously scrutinized and estimated for monthly landings jointly by the District Fisheries Officer (B&T), Balugaon and the fishery consultant representing CDA.

**Fish**

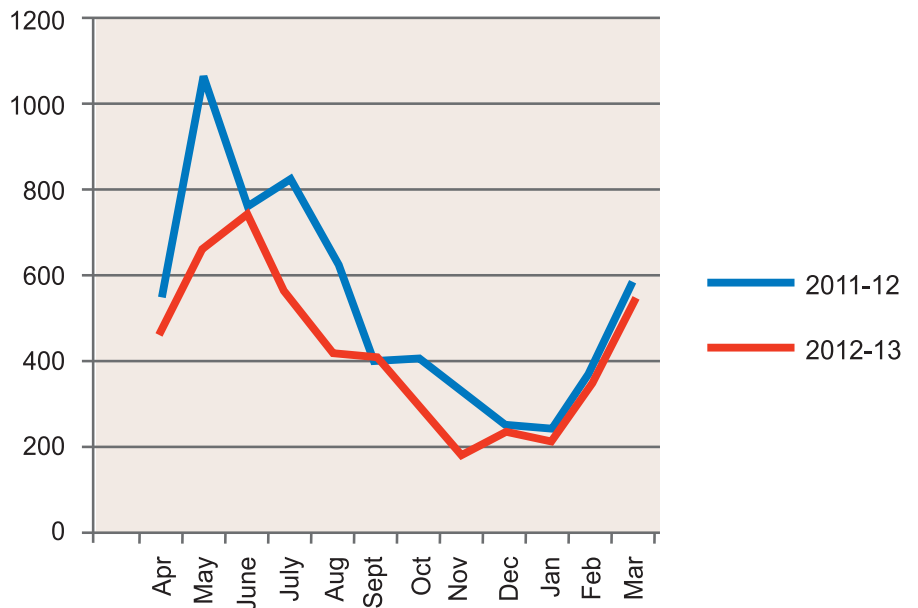
During 2011-12 & 2012-13 the total annual fish landings (fish component) from the lake were recorded to be 7456.03 and 7114.30 MT respectively showing decrease of 3.6% and 4.6% during 2011-12 and 2012-13 in comparison to the respective previous years. Higher and lower fish landings were recorded during summer and winter months respectively. Among the fish groups, clupeids comprising of *Nematalosa nasus*, *Thryssa* and *Stolephorus sp* etc contributed maximum (1569.94 MT) i.e 21.06% during 2011-12 and 1417.78 MT i.e 19.93% during 2012-13. The other important fish groups such as mullets, catfishes, perches, sciaenids and threadfins contributed 14.4%, 15.69%, 11.36%, 7.80% and 3.48% of the total catch respectively during 2011-12 and 11.20%, 16.34%, 10.99%, 8.03% and 3.54% respectively during 2012-13.



Seasonal variation in annual fish landings during 2011-12 and 2012-13

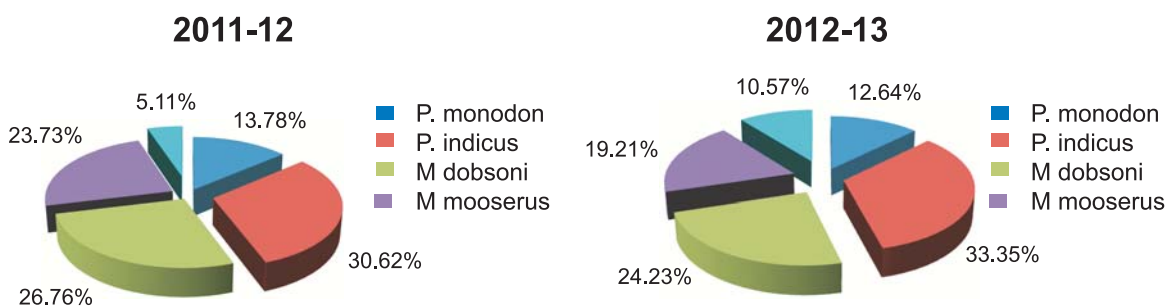
**Prawn**

During the year 2011-12 and 2012-13 the total prawn landings were 5043.18 MT and 6413.91 MT respectively as against 5043.18 MT and 6413.91 during the previous years, showing 27.18% increase over the previous year during 2011-12 and 5.92% decrease over the previous year during 2012-13. Higher and lower prawn landings from the lake during both the years were recorded during summer and winter months respectively. Prawn landings during 2011-12 (6413.91 MT) were the all time high record which formed 45.08% in the total annual landing.



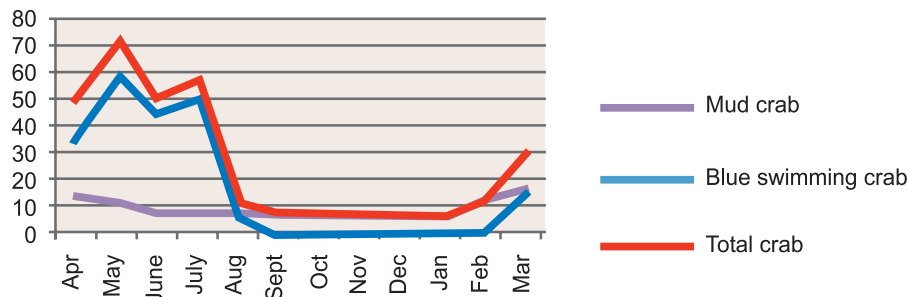
The average prawn landings per month were 534.49 and 419.50MT during 2011-12 and 2012-13 respectively, which also exceeded all previous records.

The maximum landing was contributed by *Penaeus indicus* (Kantala) with 1964.03MT in 2011-12 and 1679.01MT during 2012-13 followed by *Metapenaeus dobsoni* with 1116.29MT in 2011-12 and 1219.67MT in 2012-13. The total annual prawn landings during 2011-12 and 2012-13 included 327.68MT and 532.22MT fresh water prawn respectively. Chilika Kantala (*Penaeus indicus*) registered maximum percentage composition in the total annual prawn landings followed by *Metapenaeus dobsoni* and *Metapenaeus monoserus* during these two years. Fresh water prawns contributed 5-10% in the total prawn catch during these years.

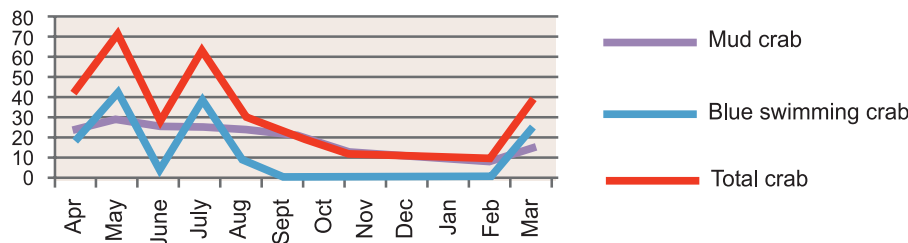


### Food Crab

During the year 2011-12 and 2012-13 total landings of food crabs (Mud crab and Blue swimming crab) were recorded to be 358.26MT and 318.58MT respectively, showing 38.38 increase over the previous year during 2011-12 and 11.07% decrease over the previous year during 2012-13. Higher crab landings were recorded during February to August which peaked in May 2011 during both the years. Mud crab



Seasonal variations in crab landings in Chilika lake during 2011-12



Seasonal variations in crab landings in Chilika lake during 2012-13

landings during 2011-12 and 2012-13 were maximum at Balugaon landing centre followed by Gangadharapur and Sorona landing centres where as landings of blue swimming crabs were maximum at Allupatana followed by Arakhakuda and Sorona landing centres. Landing of blue swimming crab (*Portunus pelagicus*) with 206.14MT during 2012-13 outwitted the landing of mud crab (*Scylla serrata* and *Scylla tranquebarica*) which was recorded at 112.44MT.

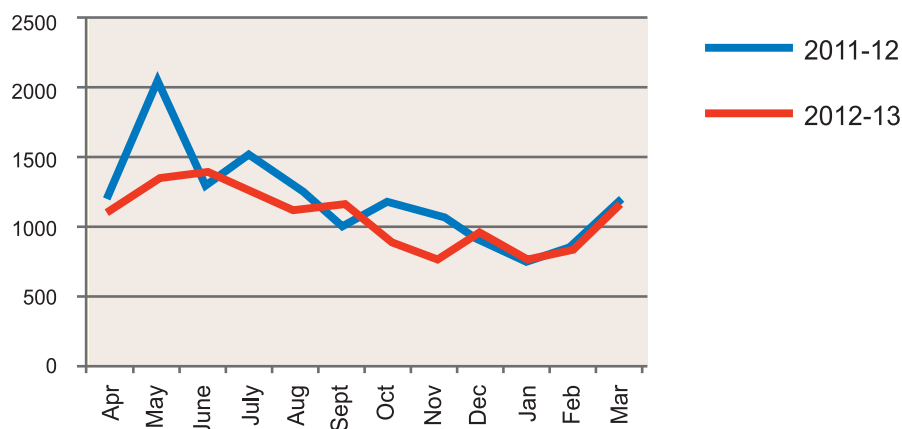
### Total landing

The total landing of fish, prawn and crab during the year 2011-12 and 2012-13 were 14228.20MT and 12466.93MT respectively as against 13065.62MT and 14228.20MT during the previous years, showing an increase of 9% during 2011-12 and a decrease of 12.38% during 2012-13.

The decrease in total landing during 2012-13 was mainly due to decrease in prawn landing by 21.5% over the previous year (1380 t less than the previous year). This is further

supported by the fact that recruitment failure in prawn fishery in Chilika lake is not uncommon which is influenced by several natural factors such as rain fall, floods, spawning strength in the coastal waters etc.

Despite the mounting pressure of destructive fishing practices and large scale encroachment of productive fishery areas for illegal *prawn ghery* operation in the lake, obstruction of inlets the overall average annual landing of the lake has been observed almost a stable trend with all time high record registered during 2011-12. The average annual landings during 2001-02 to 2012-13 (post restoration period) ranged between 9955.83MT (2006-07) to 14228.20MT (2011-12), with an average of 12070.54MT which has more or less followed the Maximum Sustainable Yield (MSY) level as estimated by CIFRI (ICAR).



Seasonal variation in total landings (fish, prawn and crab) from Chilika lake



Fish landing centre

### Capacity development training on Sustainable Fisheries and post harvest fish quality management

With a long term objective of promotion of responsible fisheries in the lake, CDA in collaboration with NETFISH (MPEDA) have initiated a long term capacity building programme for traditional fishers. from 2010 which has been continuing very successfully. The training program at the grass root level i.e. Primary Fishermen Cooperative Society (PFCS) is imparted at the fishing villages every month in a routine manner to cover all fishers village. Five number local trained NGOs have been facilitating the training program. During the year 2011-12 and 2012-13, 102 training camps in 66 fishing villages covering 71 PFCSs has been completed. In total, 3060 number of traditional fishers were imparted training on different aspects of responsible fisheries, post-harvest fish quality management, enforcement of OMFRA in Chilika for fishing regulation, governance of PFCSs, promotion of fish marketing business at PFCS level, proper utilization of soft loan assistance to PFCSs and proper use of Insulated Fish Boxes (IFB) in fishing boats.



Table-1: NETFISH-CDA capacity building training to local fishers during 2011-12 and 2012-13

Year	No. Training camps	Name of Village	Name of PFCS	NGO facilitation	No. of fisher trainees
2011-12	67	Kumarpur, Patnasi, Khatiakudi, Sorona, Mainsa, Kaudikhani, Bhusandapur refugee colony, Bhusandapur, Pathara, Berhampur, Chilika jaganathpur, Tangi, Jayantipur, Banamalipur, Jadupur, Barakudi, Baghalanji, Motto, Gourangapatana, Arkhakuda, Sanapatana, Gorapur, Parbatipur, Mirjapur, gabakunda, Sipakuda, Gangadharapur, Raipur, Satapada, panidwar, Degreesahi, Hatabaradi, Pathara, barunapada, Sabulia, Keshpur, Kalupadara, gopinathpur, Gadakokol, Gabapadar and Allandapatana	Chamunda, Kalapata, Trinathdev, Mahaveer, Mainsa, Uttara Chilika, Bhagabati, Kalimata, Gangadevi, Berhampura, Ugratarata, Laxminarayana, Pathara, Chilikajaganathpur, Jayantipur, banamalipur, Jadupur, Maamangala, Motto, Gourangapatana, Arakhakuda, Maangangadevi Maataratari, Parbatipur, Mirjapur, Gabakunda, Chaubaradevi, Budhimaa, Maapolangeswori, Satapada, Chilika Panidwar, Chilika Degreesahi, Refugee PFCS, hatabaradi, Jagulei, Maa Malati Omm Tatsat, Gopinathpur, Keshpur, Maa Bhargavi, Utarayani and Alandapatana	NJNS, Pallishree, RPRDS, DI, NC	2010
<b>Sub-Total</b>	<b>67</b>	<b>41 Villages</b>	<b>42 PFCSs</b>	<b>5</b>	<b>2010</b>
2012-13	35	Balugaon, Hatabaradi, Mangalajodi, Tentuliapada, Sorona, Berhampur, Bhusandapur, Motto, Sabulia, Chilika Jaganathpur, Banapur, Balipatapur, Kumandalapatana, Binchanapali, Barakudi, Saraswati Nagar, Gopinathpur, Totapada, Maleswari, Panidwar, Degree sahi, Gola, Mainsa, Keshpur and Parbatipur	Chandi, Mangalajodi, Bansiswarna, Pragati, Gundicharani, Durga, Maa Badabahania, Laxmi, Utkala kamala, Guruswami, Totapada, Maleswari, Maa PFWCS, Hatabaradi, Bhagabati, Utarayani, Bhusandapur, Motto, Refugee, Chilika Jaganathpur, Maa Mangala, Saraswati Nagar, Gopinathpur, Panidwar, Degree Sahi, Gola, Mainsa, Omm Tat Sat and Parbatipur	NJNS and RPRDS	1050
<b>Sub-Total</b>	<b>35</b>	<b>25 Villages</b>	<b>29 PFCSs</b>	<b>2</b>	<b>1050</b>
<b>Total</b>	<b>102</b>	<b>66</b>	<b>71</b>	<b>5</b>	<b>3060</b>



Chilika fishers attending NETFISH-CDA capacity building training camps at Khola Munha and Rasokudi fishing villages

## Post-harvest fish quality management

### Supply of insulated fish boxes to Chilika fishers

As an integral part of sustainable fisheries, highly efficient Insulated Fish Boxes (IFBs) of 70-100 litre capacity were supplied to Chilika fishers through their PFCs as an important step towards post-harvest fish quality management by maintaining cold chain system and to enhance the fisher's income by realizing better price. MPEDA and CDA jointly subsidized the cost of IFBs to the extent of 50% and 30% respectively. The scheme was introduced in Chilika during 2010-11 with supply of 1511 boxes. During 2011-12 and 2012-13, 1226 and 2069 boxes were supplied totalling to 4806 boxes during these 3 years. In total, 4806 traditional fishers in Chilika were benefited by maintaining their catch quality and realizing 30 to 40% higher prices. The Assistant Registrar, cooperative Society (Fy), Chilika Circle, Balugaon was entrusted by CDA for procurement, supply to fishers and monitoring the utilization of IFBs. So far, MPEDA and CDA have provided subsidy to the extent of Rs 50,93,450 and Rs 30,56,070 respectively under the programme.



Insulated fish box used by fishers in fishing boat



Use of insulated fish box in a PFCs fish godown for marketing at Jayantipur

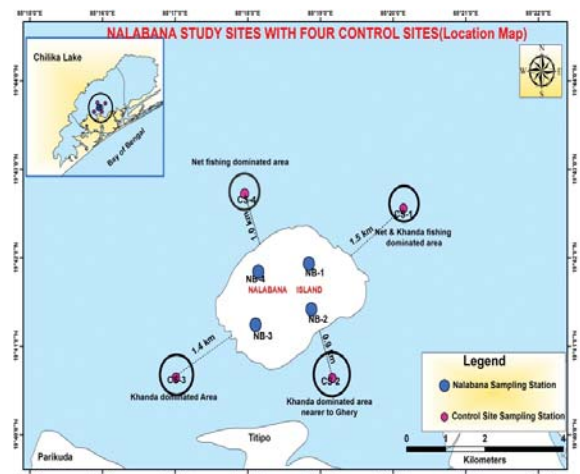
### ICZMP-CDA: Species research (Fisheries Research Studies)

Under the World Bank assisted Integrated Coastal Zone Management Project (ICZMP), Odisha Chilika Development Authority has initiated species research to bridge the knowledge gaps at Wetland Research and Training Centre (WRTC), Barkul during the year 2011-12 which are in progress. Two research programs on fisheries resource were initiated during 2011-12 and continued in 2012-13. The salient findings of these research studies are as under:

#### Ecological Assessment of Nalabana sanctuary as a potential nursery and spawning ground for finfish and shellfish

Nalabana is a notified Bird Sanctuary, fishermen are not allowed to fish inside the Sanctuary as per the provision of the Wildlife Act. The objective of this study is to find out how ecosystem of the Sanctuary is supporting the spawning & serving as a nursery for the species.

The ecological parameters of the Sanctuary i.e. water quality (Environmental) variables, physico-chemical properties of sediment macro-zoo benthic community, plankton and macrophyte biomass and diversity have been studied following standard methods. During







Research studies at Nalabana (Site map & field sampling)

the course of study, abundance of post-larvae of 8 species (*Hemiramphus limbatus*, *Datnioides polota*, *Etroplus suratensis*, *Glossogobius giuris*, *Aplocheilichthys panchax*, *Oryzias dancena*, *Pestipachus sephen* and *Mystus gulio*) with availability of their matured (gravid) specimens and eggs were observed and collected which confirmed that these species spawn in Nalabana area. Similarly during the period of study abundance of juveniles of more than 45 species of fish and prawn were encountered which indicated that the protected sanctuary area appears to be a potential nursery ground (further study of food of the juveniles in relation to the available food in the habitat will confirm this finding). The overall ecological assessment indicated that Nalabana forms a favourable habitat as a potential nursery and spawning area for some fishes and shellfishes of the lake.

### Biology of Chilika Dangala, *Chelon macrolepis*(Smith, 1946) from Chilika Lake

Dangala(*Chelon macrolepis*) is one of the high value target fish species of Chilika lake. Its biology was hitherto not studied from Chilika lake and from other regions except one study from the Gulf of Mannar (India) in 1963. The present study was initiated by CDA during July 2011 which is now in progress at present.



Chilika Dangala (*Chelon macrolepis*)

The length frequency study indicated that growth over-fishing has occurred for this species in the Lake which warrants size regulation measures through enforcement of regulatory laws. So far the study has indicated changes in the breeding migration routes and breeding cycle. Other important biological parameters i.e. relative condition factor, gonado somatic index, length-weight relationship food (gut content) analysis, progression in maturity stages, size at maturity etc are being studied. The study is nearing completion.



Fish biology study at WRTC laboratory

### ICZMP/CDA-CIFRI Consultancy Project

The Consultancy Project “Post-restoration assessment of the ecology and fisheries diversity of Chilika Lake” was awarded to Central Inland Fisheries Research Institute (CIFRI) on 21.10.2011 for a period of five years. A 12 members team of research scientists/technicians and SRFs of the institute are involved in the project. The studies as per the schedule for completion of tasks and deliverables as mentioned in the contract document has progressed well since launching workshop held at CIFRI on 10<sup>th</sup> Feb 2012.

The long term study broadly includes collection of baseline information and fixation of sampling stations, water and soil/sediment quality, primary productivity, fisheries parameters, biology of selected fish species, population studies and stock assessment of selected fish species, fish assemblage structure and factors influencing them, interim recommendations for management intervention to improve potential and prevent over exploitation. Besides, the consultant (CIFRI) is to provide capacity building training to the CDA personnel and shall assist in publication of research findings in the book forms. CIFRI has conducted two successful training programs at CIFRI for CDA personnel till March 2013.



CIFRI scientists collecting fishery data at Kalupada fish landing centre of Chilika lake

### The major findings and interim recommendations by CIFRI were:

- The commercial fish catch showed that growth over fishing (catch below the length at first maturity) has taken place for 4 commercial target species (*E. tetradactylum*, *M. cephalus*, *D. Albida* and *E. suratensis*) except for *V. Cunnesius*, which warrants early conservation measures such as gear and size restrictions.
- In total, 164 finfish species, 12 prawn species and 9 crab species were collected from the lake during inventorial survey. The total collections included six new records of finfish (*Favonigobius reichei*, *Neotropius atherinoides*, *Zebrias synapturoides*, *Taenioides angullaris*, *Narcine timlei* and *Johnius borneensis*), adding to the fish diversity.
- Although most of the targeted heavy metals were below detectable levels, low levels of Cu and Mn in water and soil indicated need for monitoring of metals in the lake.
- Death and decay of macrophytes at few localized area due to absence of proper water circulations caused localized water quality problems which emphasizes management of macrophytes in the lake.
- The detection of heavy metals and some pesticide residues in the fish body need close monitoring as to assessment of magnitude and source of influx. Harmful heavy metals were not detected from fish and shrimp muscles.





CDA's research scholars are at work in the CIFRI laboratories during training

### Strengthening Primary Fishermen Cooperative Societies

For sustainable management of fisheries resources in Chilika Lake, strengthening/empowerment of the existing 117 number of PFCSs was considered as a prime requisite. A beginning in this direction was made in 2010 with the establishment of a new Apex society called Chilika Fishermen Central Cooperative Society (CFCCS Ltd) at Balugaon in which the Chief Executive of CDA as the officiating President of the society. Till now, 85 PFCSs out of total registered PFCSs of 117 have been affiliated to the CFCCS Ltd. During the last two years, a total of Rs 6 crores (Rs 2 crores provided by State Govt. and Rs 4 crores provided by CDA) has been provided to CFCCS Ltd with an objective to provide financial assistance to the PFCSs as soft loan with 4% simple interest to liberate the PFCSs from the clutches of money lenders so that they can take up fish marketing business at society level which would improve their economic condition. So far, 22 PFCSs have been provided such financial assistance of Rs 10 lakhs each and survey is in progress to identify eligible PFCSs for further loan assistance. Some of the liberated PFCSs have already started their won fish marketing business and the fisher members have been benefited financially by getting better price from sale of fish.

### Inlet Dynamics??

#### Monitoring the inlet of Chilika using Acoustic Doppler Current Profiler (ADCP):

The inflow of the sea water through the inlet of Chilika plays a crucial role in maintaining the salinity gradient which in turn influences the Lake Ecosystem. Flow discharge was measured using ADCP (Acoustic Doppler Current Profiler) at four locations (Fig-1) near old mouth and new mouth of Chilika during flood and ebb tidal phases at one hour interval to know the tidal prism.

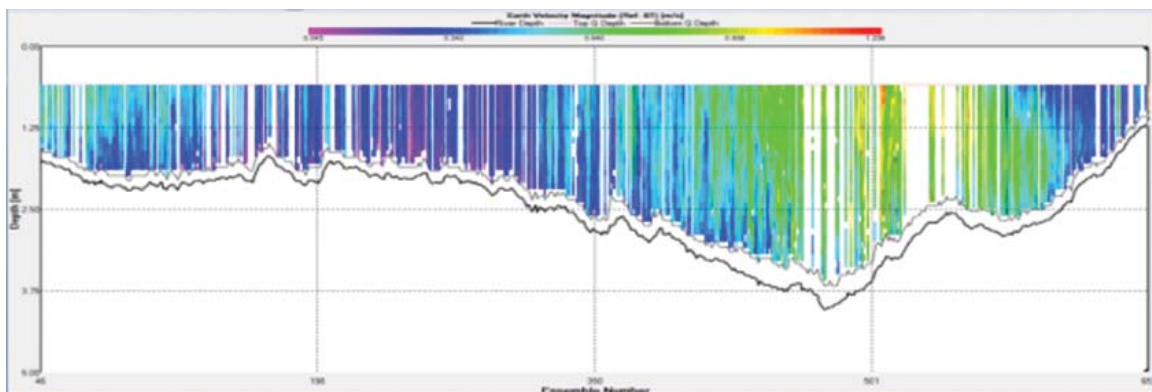


(Fig-1)

The details of measurement location are:

Transects	Geographical Coordinates (WGS 84)				Approximate width of Channel(m)
	Start Coordinate		End Coordinate		
	Latitude, N	Longitude, E	Latitude, N	Longitude, E	
TR1 - Main channel (Gabakunda mouth)	19° 40' 16"	85° 31' 10"	19° 40' 08"	85° 31' 11"	325
TR2 - Secondary channel (Gabakunda mouth)	19° 40' 33"	85° 31' 27"	19° 40' 31"	85° 31' 19"	275
TR3 - Main channel (Dhalabali mouth)	19° 41' 02"	85° 31' 57"	19° 40' 56"	85° 31' 59"	750
TR4 - Secondary channel (Dhalabali mouth)	19° 41' 09"	85° 32' 51"	19° 41' 12"	85° 32' 41"	850

The total volume of seawater entering the Lake through mouth during the flood tide) at various tidal conditions through Gabakunda and Dhalabali inlets were computed as follows;



A snapshot of ADCP observation

Region	Spring Tide		Neap Tide	
	Flood (m <sup>3</sup> )	Ebb (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Ebb (m <sup>3</sup> )
Gabakunda mouth	13.8 x 10 <sup>6</sup>	12.2 x 10 <sup>6</sup>	8.0 x 10 <sup>6</sup>	7.1 x 10 <sup>6</sup>
Dhalabali mouth	7.6 x 10 <sup>6</sup>	8.3 x 10 <sup>6</sup>	7.6 x 10 <sup>6</sup>	8.0 x 10 <sup>6</sup>

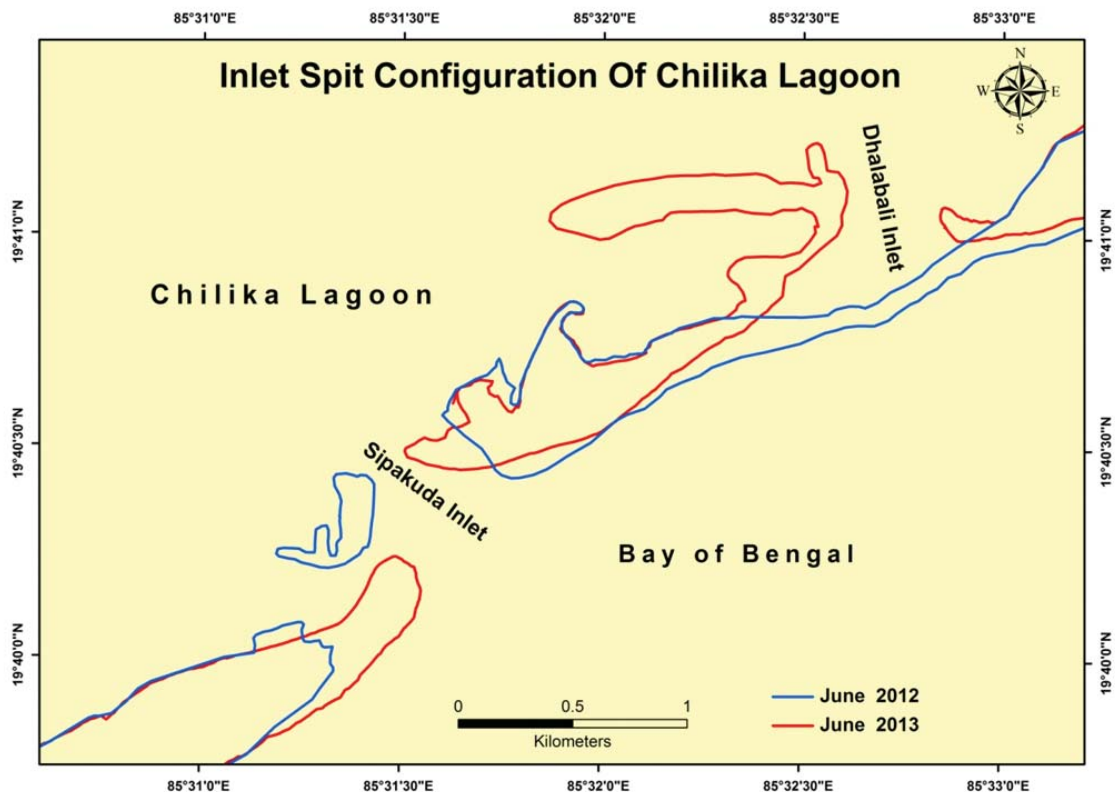
The tidal prism at Gabakunda mouth was observed to be 13.8 x 10<sup>6</sup> m<sup>3</sup> during spring tide and 8.0 x 10<sup>6</sup> m<sup>3</sup> during the neap tide. Interestingly no significant variation in the tidal prism was observed during the spring and neap tide at Dhalabali mouth. The tidal prism at the newly formed Dhalabali

mouth was observed to be around 50% of the tidal prism observed through Gabakunda mouth. However, the geometry of Dhalabali mouth is highly unstable and proportionally the tidal prism will also be decreasing.

The tidal prism observed at Sipakuda mouth when the first intervention was made in 2000 was  $10 \times 10^6 \text{ m}^3$ . As can be seen the tidal prism (after the original inlet migrated to about 900 mts) at Gabakunda inlet is higher than in comparison to Sipakuda inlet in 2000. The increase in tidal prism is due to the increase in cross section due to two inlets. The tidal prism prevalent at Gabakunda mouth is carrying the seawater to the main lake.

### Study of the spit configuration

The inlet of Chilika Lake regulates the Lake hydrology. The inlet is greatly influenced by the long shore sediment transport and the other coastal processes. The inlet dredged open in front of village Sipakuda has migrated in North East direction by about 900 mts during last 12 years. The figure depicts the temporal variation of adjacent shoreline of Chilika Inlet from June 2012- June 2013. The south spit getting elongated in the northeasterly direction whereas the middle sand dune has been washed out. The Northern barrier also getting eroded due to littoral drift and longshore transport.





# Research Highlights





The Chilika Development Authority (CDA) in its ongoing mission to protect lake genetic diversity and promote wise use of resources has been implementing several long-term research studies to bridge the knowledge gaps that are sponsored by World Bank assisted Integrated Coastal Zone Management Project(ICZMP). These research activities are commissioned in collaboration with premier institutes of India such as CIFRI, BNHS, IISER, RPRC, and KIIT University School of Biotechnology. These studies are focused on ecologically and economically important component of Lake Ecosystem such as fishes, birds, macrophytes, benthos, and microbial communities of Chilika Lake ecosystem. An outline of these studies in context to wetland resource management is as follows;

### **Monitoring water birds population and habitat assessment in Chilika Lake**

Chilika and in particular the Nalabana island due to its rich biodiversity and unique ecological conditions offers a major wintering ground for many migratory waterbirds. CDA in collaboration with Bombay Natural History Society (BNHS) has commissioned a study to monitor bird ecology with special focus on the habitat management in the lake. This study is monitoring, species wise composition of migratory birds, waterfowl, and waders in Chilika Lake and is trying to identify biohydrological parameters that are conducive for waterbird congregation. This study has also proposed a habitat management plan for creation of new islands similar to Nalabana to minimize the overcrowding.

In year 2012, fortnightly bird counts, arrival dates for migratory birds, and surveillance for dead and sick birds was recorded from the Mangalajodi, Nalabana, Rambha, Kalupadaghat, Gurubai, Palur, and Parikud sites.



*Birds in the northern sector of Chilika Lake*

A total of 8,68,512 individuals of 106 water bird species were estimated in the counting from the entire lagoon. Among the ducks, in three species (Gadwall, Northern Pintail and Eurasian Wigeon) the population exceeded over one lakh. There were no duck congregations sighted between Chandraput to Nalabana and Barkul to Balugaon. A total of eight near threatened species namely Pallas Fish Eagle (*Haliaeetus leucoryphus*) Asian Dowitcher (*Limnodromus semipalmatus*), Spotbill Pelican (*Pelecanus philippinus*), Oriental Darter (*Anhinga rufa*), Eurasian Curlew (*Numenius arquata*), Eurasian Spoonbill (*Platalea leucorodia*), Painted Stork (*Mycteria leucocephala*) and Black-tailed Godwit were observed at Nalaban. Besides wetland birds, terrestrial bird numbered 14,548 in 61 different species were sighted this year, bringing the grand total of the species (water birds and wetland dependent birds) to 167 species. Eastern Curlew, Goliath Heron, Glossy Ibis, Slender billed Gull, and Collared Pratincole were new bird records in year 2012. A total of 778 birds were ringed during 2012. A total of six oral, cloacae, and blood serum samples were collected from birds at Nalaban also samples were sent to High Security Animal Disease Laboratory at Bhopal. None of the samples were found positive for avian H5N1 virus. Several threats to bird habitats such as prawn gherries and increased weed covered area were observed in Nalabana and Parikud. It has been noted that the entire exposed mudflats in Parikud—the only feeding and roosting place for the wintering waders in Chilika during their arrival time (November-December) is either destroyed or altered due to illegal prawn gherries. *Phragmites karkaw* which was initially confined to some patches in Nalabana, has started proliferating to other areas of island and might pose threat to waterbirds that prefers open water surface for resting and diving.



Birds congregation the Nalaban sanctuary of Chilika Lake

### Assessment of macrophyte biodiversity in Chilika lagoon and its shoreline

Macrophytes are excellent bioindicator of wetland's ecosystem health and also provide specific ecological services such as shelter to fishes, aquatic invertebrates, and breeding grounds to the waterbirds. CDA in collaboration with Regional Plant Resource Centre (RPRC), Bhubaneswar initiated a comprehensive investigation on mapping of macrophytes of lake water and terrestrial plants growing in lake, shorelines, and islands. Once completed, this World Bank funded study will provide an excellent resource inventory specifically focused on macrophytes. The data will be useful in formulating appropriate conservation and management strategies, stock assessment, and habitat improvement. This four year research study has following specific research objectives i) resource inventory, quantitative assessment, and mapping of aquatic macrophytes and terrestrial plants (ii) analysis of the diversity, distribution, density of aquatic angiosperms and their correlation with physicochemical properties of Lake Ecosystem (iii) study on distribution, succession, association, species composition, regeneration potential of vegetation of shorelines and islands (iv) assessment of yield and productivity of aquatic macrophytes and their economic contribution to the livelihood of local people (v) identification and study of the extent of distribution and spread of invasive weed species. This study during its first year of inception has carried out quantitative ecological studies on terrestrial and

aquatic vegetation at several sites such as Badakuda, Kalijai, and Kalijugeswar islands. Shoreline vegetation was analyzed at six sites namely Langaleswar, Pathara, Godinala, Patna, Tentuliapada, Keshpur. Plant specimens were collected, identified, and preserved as herbarium specimens. Current satellite based macrophyte distribution maps of Chilika Lake were analyzed and validated for ground reality. Plant specimens were collected, identified, and preserved as herbarium specimens. In year 2012, a total number of 334 species of Macrophytes (angiosperms) belonging to 256 genera and 87 families have been collected, described and identified with the help of regional floras and monographs. Plant specimens of over 200 species have been dried, poisoned, annotated and stored as herbarium specimens following standard field and herbarium methods. 14 species turned out to be new distributional records for the flora of Chilika Lagoon and its adjoining regions. *Bistella digyna* in Chilika is a new plant record for the state of Odisha. Molecular characterization and genetic diversity assessment of selected rare and endangered plants and relict mangroves will be taken over in the next phase of ongoing research.



*Halophila and Halodule the predominant sea-grasses from Chilika Lake*



*Cassipourea ceulanica*



*Macrotyloma ciliatum*



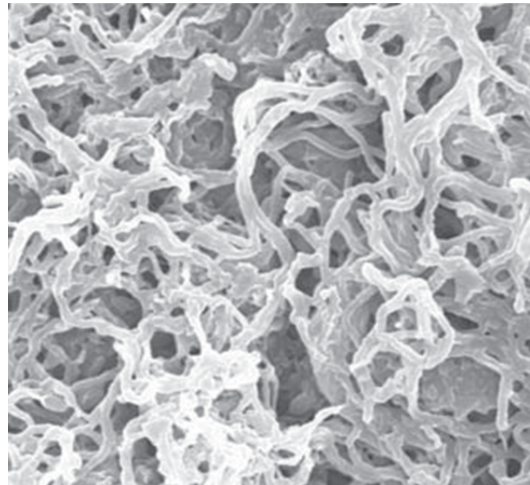
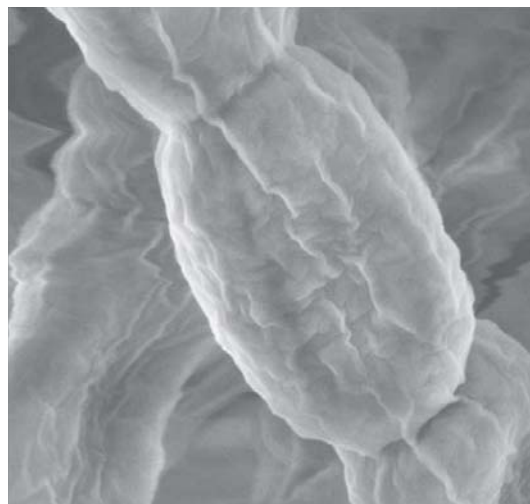
*Vigna trilobata*



*Gyrocarpus americanus**Aegiceras corniculatum**Halophila beccarii*

### Studies on characterization and bioprospecting of microbial communities from Chilika Lake

Wetlands in general host a complex community of bacteria, fungi, and other microorganisms. In wetland sediments, oxygen concentration is depleted very rapidly within few centimetres under water surface. Under such anaerobic conditions, benthic microbial communities eventually mineralize the carbon and nitrogen into gaseous products such as CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub> thus completing the biogeochemical cycle of these elements. These microbial communities are mainly composed of fermenting bacteria, methanogens, and denitrifying bacteria. Given the importance of wetlands in acting as kidneys of the landscape, it is essential that a greater understanding of microbial communities and their processes will provide knowledge on the specific pathways through which organic matter is mineralized in the wetland ecosystem. Recently, CDA and KIIT School of Biotechnology have started a joint research study to bridge the knowledge gap in the area of microbial ecology of Chilika Lake ecosystem. This three year study which is funded by ICZMP will do extensive research to understand structural and metabolic diversity of benthic microbial communities their role in biogeochemical cycling carbon, nitrogen, and phosphorus in the Chilika lagoon. Bio prospecting of important enzymes from the novel microbial cultures isolated from the Chilika is underway. A bacterial culture collection has been established and detailed characterization of these strains through biochemical and molecular methods is ongoing. In

Aerial mycelia of *S. chilikensis*Spores produced by *S. chilikensis*

this direction, recently a new halophilic bacterial species; *Streptomyces chilikensis* was isolated from the brackish sediments of Chilika that can grow at pH 10. This species produces protease, cellulase, and lipase enzymes under alkaline pH and high salt conditions, a property which is important in

developing new biotechnological application. These finding suggests that Chilika is a reservoir of many novel bacteriathat could be an unexplored source of novel gene and bio-products.

### Study on the economic uses of *Phragmites karka*

#### Paper made from *P. karkaa* reed

*Phragmites karka* (*P.karka*) is a large perennial invasive weed that grows extensively as an emergent macrophyte in Chilika including the shorelines. This weed is well-tolerant to alkaline and high salinity conditions. Changes in the salinity regimes of the Chilika due to the opening of a new mouth has resulted extensive proliferation of *P. karka*, especially in the northern sector. Invasion of this weed is facilitated by disturbances such as increased nutrient loading from the catchment area, alteration of the natural hydrologic regime, dredging, and increased sedimentation. The rapid expansion of this weed has reduced the open water area for navigation and breeding ground for fishes and birds.



Paper made from *P. karkaa* reed

CDA in collaboration with KIIT School of Biotechnology is evaluating different economic uses of *P. karka* which can provide sustainable livelihood and management solution for this weed. *P. karka* has high fiber content which makes it suitable for making paper, card board boxes, and wood tiles. In order to evaluate use of *P. karka* for paper production, a laboratory scale technique has been developed using root, stem, and leaves. This method provided an excellent quality of paper which by further optimization of process could lead to a sustainable source of alternative livelihood for fishermen communities.



Research team collecting weed samples from shore line invaded with dense patches of *P. karka*



Dense patches of *P. karka* in the northern sector of Chilika lagoon



### Monitoring of macro- and meio- benthic fauna to assess the ecological health of Chilika

Benthic communities are tiny creatures that reside in the sediments and play very important role in regulating the overall functioning of Lake Ecosystem. Based on their size they can be divided as macro (> 500  $\mu$ m) and meio (>42-63  $\mu$ m) benthos. Many members of these benthic fauna are considered very sensitive indicators of pollution status of coastal lagoons. For example, presence of *Chironomus* sp. in water body indicates anoxic conditions and thus is a bio-indicator of oxygen level. CDA in collaboration with IISER Kolkata has started taxonomic characterization of benthic fauna from four ecological sectors of Chilika lagoon. This will lead to an understanding of spatial and temporal patterns in benthic communities and the major environmental drivers (such as nutrients, physicochemical parameters) that regulate their diversity and composition in Chilika Lake. This study will apply modern phase-contrast microscopy and scanning electron microscopy coupled with digital imaging to prepare a monograph of benthic community of Chilika. The monograph will be pictorial in nature and could be used by research personnel working on benthic organisms to monitor the pollution status of Chilika lagoon.



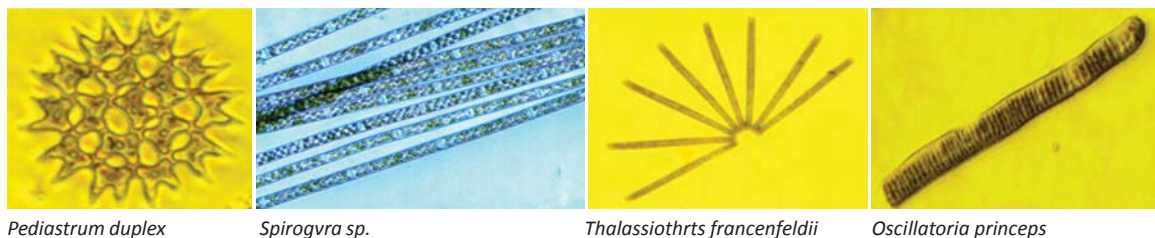
*Gastropods recovered from Chilika Lake*

### Monitoring planktonic and benthic biodiversity of Chilika Lake

The information on planktonic and benthic communities and their spatial and temporal variation is very limited for Chilika Lake. In order to bridge this knowledge gap, CDA took a systemic research approach to further strengthen the 'Species Biology' research at Wetland Research and Training Centre. Planktonic communities are important biodiversity component in aquatic food web. Research data collected on phyto-planktons taxonomic identification revealed a total of 326 species of phytoplankton under 6 groups during the period of observation from July-2011 to Feb-2013. Among them, diatoms were represented by 155 species, dinoflagellates-49 species, green algae-41 species, blue green algae-45 species, euglenoids-32 species and silicoflagellates-4 species. Diatoms dominated over other groups in Southern Sector, Central sector, and Outer Channel; whereas the fresh water forms like green algae, euglenoids and cyanobacteria were predominant in the Northern Sector.

A total of 20 types of zooplankton groups (>120 $\mu$ ) were encountered along with 15 forms of larvae or meroplankton during the study (September-12 to February-13). Sectoral and monthly, the average total zooplankton population density varied from 393 org./m<sup>3</sup> to 60532 org./m<sup>3</sup>; mostly Copepoda was the dominant group in all the sectors. Other zooplanktonic groups encountered in the study were amphipods, cladocerans, insecta, isopods, decapods, mysids, ostracods, appendicularians, chaetognaths, foraminifers, gastropods, hydrozoans, nematodes, rhizopoda, rotifers, tintinnids, cirripedenauplii, cirripedecypris, caridean larvae, copepod nauplii, bivalve veliger, brachyuran zoea, bryozoans larvae, fish egg & larvae, echinoderm larvae, gastropod veliger, polychaete larvae, protozoa

of lucifer etc. Both marine and fresh water species of phytoplankton and zooplankton were observed during the study justifying the brackish nature of the lagoon.



Macro benthic organisms are the sediment dwelling organisms that play a vital role in aquatic ecosystems by providing energy to higher trophic levels. Macro benthic population density and biomass also provide significant information regarding the kind of stress imparted upon the ecosystem. Thus, presence or absence of benthos can provide the possible information regarding environmental status of the aquatic ecosystem. In considering to the above fact, macro benthos study was carried out for a period of one year i.e. from April 2012- March 2013. During this study period, higher values of population density were seen in monsoon season followed by post monsoon season. The higher value of biomass was seen in post monsoon season followed by monsoon season. The macro benthic density for whole lake was highest in southern sector as  $695 (\pm 352)$  No. /  $m^2$  and macro benthic biomass was highest in outer channel area by  $30.25 (\pm 25)$  g/  $m^2$ . Polychaeta was recorded as the major dominant group followed by the amphipods.

### Up-gradation of WRTC

The Wetland Research and Training Centre(WRTC) is a primary nodal lab of CDA for conducting wide range of research programs related to sustainable management and conservation of lake biodiversity. The centre has excellent infrastructure for lake health monitoring and biodiversity assessment. In order to further upgrade the research facility and meet global standards in the area of molecular biotechnology, biogeochemistry, and benthic research, World Bank under the ICZM project generously supported the procurement of advance equipments such as Atomic Absorption Spectrophotometer, Gas Chromatography, Inverted Phase Contrast Microscopes, High Performance Liquid Chromatography, Total Carbon Analyser and Auto Analyzer. These state of the art equipments will be used in extensive monitoring of lake health via the measurement of different pollutants, pesticides, and nutrient levels as well as to understand the complex geochemical cycle of Lake Ecosystem. Procurements of instruments related to molecular biotechnology research such as Polymerase Chain Reaction machine, Real-Time PCR and BIOLOG, is currently underway and is expected to be completed within next 6 months. Establishment of a molecular biotechnology lab will further strengthen the 'Species Research' programme and research projects related to molecular microbial ecology, bioprospecting, and molecular inventory of bioresources of Chilika Lake will be initiated.

# Lake Health Monitoring





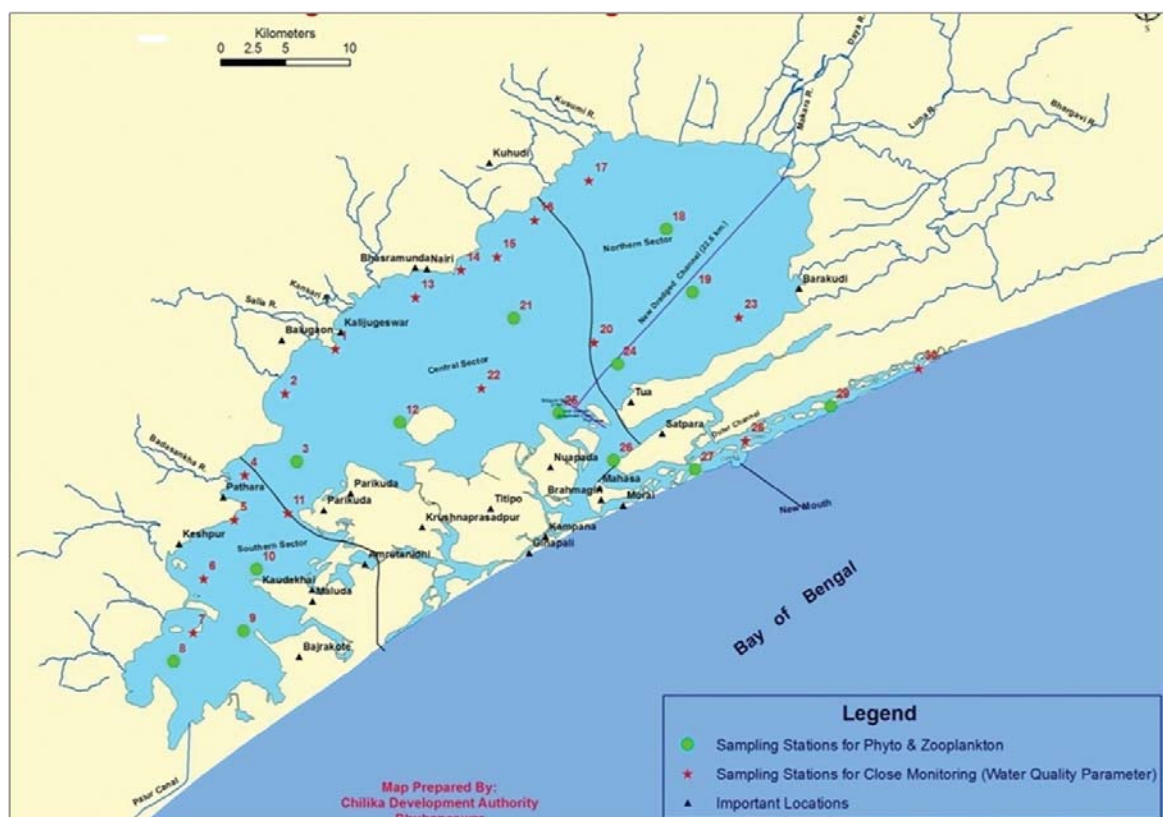
To further strengthen the Species Biology Research and to continuously monitor the Lake health, CDA has two major research projects.

(i) Water quality monitoring of Chilika Lake: CDA under the project “Water quality monitoring of Chilika Lake” is conducting monthly survey of physical, chemical, and biological parameters of lake. Water and sediment samples are collected from 30 pre-fixed stations and are analyzed on board for pH, temperature, salinity, conductivity, turbidity, and depth. In lab, samples are analyzed for nitrate, nitrite, phosphate and, dissolved oxygen. Among the biological parameters; diversity of benthic and planktonic communities, primary productivity and chlorophyll concentrations are recorded.



From monitoring point of view, Chilika is very complex and heterogeneous ecosystem as there is high degree of spatial and temporal variability in the physiochemical parameters primarily due to constant tidal mixing of fresh and sea water. This monthly water quality report provides data on early warning biogeochemical indicators before changes are appeared at macro-fauna level.

Recently, CDA has also installed state of the art real-time water quality monitoring system (data buoy) at 10 strategic locations in Chilika Lake. Each data buoy has sensors for salinity, temperature, turbidity, conductivity, dissolved oxygen, pH, chlorophyll, and blue green algae. These data buoys transmit data every 15 min on real-time basis to modeling cell located at Wetland Research and Training Centre. In the modeling cell, data is analyzed closely to reveal any spatial and temporal pattern in context to the health status of lake. The data buoys have been procured from the ICZMP-CDA project for ensuring the sustained lake health monitoring programme.



Location of 30 sampling stations across four ecological sectors of Chilika Lake

### Real time water quality monitoring system in Chilika lagoon

Real time water quality monitoring systems are the data Buoys that provides the data necessary to monitor the health of the ecosystem and to track the impacts of natural or man-made events on real time. The data buoy measures the following parameters:

1. Temperature
2. Conductivity
3. pH
4. Optical Dissolved Oxygen
5. Turbidity
6. Chlorophyll (in-vivo fluorimetry tech.)
7. Blue Green Algae(PC/PE)

The deployment Platform contains 2 x 10W Solar Panel and 24AH battery, Integral Sonde deployment tube and cable and High gain submersible GSM/GPRS communication antenna (Fig.x)



Fig. x Data buoy deployed in Chilika to monitor water quality parameters

The extensive data helps to understand the Wetland system dynamics, processes and behavior. These long term data also can be useful for the development of coefficients which can be implemented in model and to develop model (real time) to predict the water quality of the Lake in future. The system has been set to provide data in 15 minutes interval, which can provide a clear picture with respect to diurnal cycle for each parameter. Early warning of the bloom can be noticed in case of increasing trend of BGA. In this regard the real time water quality monitoring system was deployed in 10 stations as mentioned in the Fig.x and Fig.y

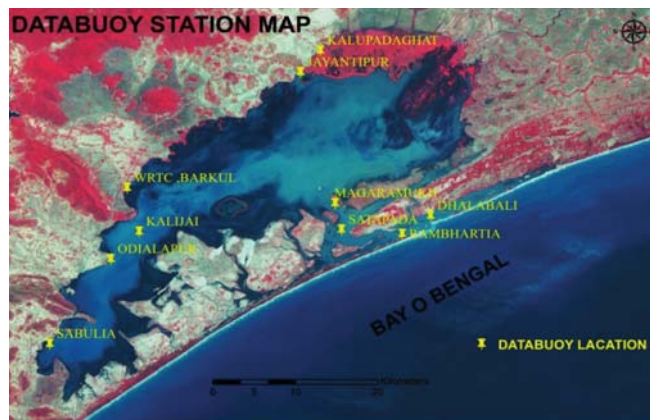


Fig.y Locations of Data buoy deployment

The advantages of Real-time Telemetry are that we access the real data every hour and it identifies problems when they happen. It monitors changes in water quality at various temporal scales (long term). The system maintains high quality data due to optical sensors and its repeated measurements.



Fig.z Deployment of data buoy in Chilika lagoon



## Chilika Ecosystem Health Report Card

CDA has a long term desire to use the scientific data collected during lake health monitoring program in a way that is easily understandable to coastal community and policy makers. With this objective, CDA has collaborated with Institute for Ocean Management, National Centre for Sustainable Coastal Management, Chennai and University of Maryland, USA to initiate the development of a “Chilika Ecosystem Health Report Card”. This report card will be a very simple and timely method to report the health of Chilika Lake on annual basis. This would be transparent science communication to wider audience. Quantitative assessment of lake health will be done based on ;Water clarity, Dissolved oxygen, Chlorophyll-a, Total catch, Commercial fish species diversity, Bird count and richness, Dolphin abundance ,Benthic faunal diversity& Phytoplankton diversity.

Scores will be given to each indicator based on the threshold values which will be then combined for both indices to calculate health report card grades.

Health report card is a media to transfer in depth scientific knowledge to simplest conceptual presentation which can be understood by common people .The health of the system can be understood in terms of Color code, integrating the physico-chemical, biological property of the water and sediment. This is the first ever attempt in Asia to prepare the health report for a wetland. In this regard a four day “Workshop on coastal ecosystem health report card for Chilika lagoon” was conducted in Bhubaneswar from 4<sup>th</sup>-7<sup>th</sup> February 2013. Experts from University of Maryland, USA, NCSCM, India and CDA discussed on the research experiences on the subject and on the need to have the most accurate health report card for Chilika.

The threshold values were fixed as per the literature referred as well as on the basis of the decadal data collected by Chilika development Authority. The health report card can say the condition of the



**Chilika Lake**  
2012 Ecosystem Health Report Card

### Chilika Lake is rich in natural and cultural beauty, and important to local livelihoods

Chilika Lake stores monsoon flood waters and provides a level of salinity needed to sustain its amazing biodiversity of life. Local communities depend on the Lake to provide water for fish and shellfish for food and resale, village transport, and tourism income. It is for all these reasons that Chilika Lake needs our protection.

### Pressures affecting the Chilika Lake ecosystem

Chilika Lake is subjected to constant pressures from both natural processes and human activities. The problems highlighted here are overfishing, pollution, tourism, and sedimentation, all of which can result in a degradation of the Lake. By identifying these pressures through efforts like this ecosystem health report card and subsequent management actions, the livelihood of Chilika Lake to sustain itself is improved.

#### Fishing and Aquaculture

The recent abundance of fish stocks is not sustainable with overfishing and so many fishers, and fish traps back into the water contribute the Lake. Active shrimp pens and abandoned nets trap sediment and kill juvenile fish.

#### Pollution

As land use changes from forest to settlements and paddy agriculture, sewage and fertilizer runoff increases into the Lake. Algal blooms that float and sit on the bottom are the result of extra nutrient input.

#### Tourism

While tourism is providing welcome income to local communities, the activities, if not managed properly, adversely impact the environment. Air pollution, trash, visibility disturbances, noise and rapid village growth are increasing around and on the Lake.

#### Sedimentation

During monsoon season, an excess of sediment is deposited in the Lake, mostly from Mahabadi River tributaries, nearby settlements, and agricultural lands. As the Lake becomes more shallow and its sea outlets fill in with sediment, increased flooding occurs.

### How the report card was prepared

This is the first of a proposed series of annual Ecosystem Health Report Cards for Chilika Lake. The report card was developed in order to enhance understanding and management of the Chilika Lake ecosystem through a collaborative project on “Global Foundations for reducing nutrient enrichment and oxygen depletion from land based pollution, in support of Global Nutrient Cycle” by Chilika Development Authority (CDA), National Centre for Sustainable Coastal Management (NCSCM), and United Nations Environment Programme (UNEP/GEF).

The CDA, in partnership with NCSCM and the Integration & Application Network from the University of Maryland Center for Environmental Science, convened a science workshop bringing together local, regional, and international experts and stakeholders, who together identified 10 indicators of ecosystem health currently monitored within the Lake, and developed thresholds for each. Additional indicators may be included in future print measures for data collection as in place. This first Report Card serves as a baseline that will be used as a point of comparison to measure progress towards Chilika Lake management goals and targets.

### Measures of ecosystem health

Measuring the ecosystem health of Chilika Lake is conducted using 10 indicators organized into three main indices: Water Quality, Fisheries, and Biodiversity. Together, these indicators represent the ecosystem features of Chilika Lake that are valued (e.g., fishing, tourism, biodiversity), and represent the threats (e.g., overfishing and illegal aquaculture, pollution, and sedimentation) to these values.



### Desired conditions guide ecosystem change

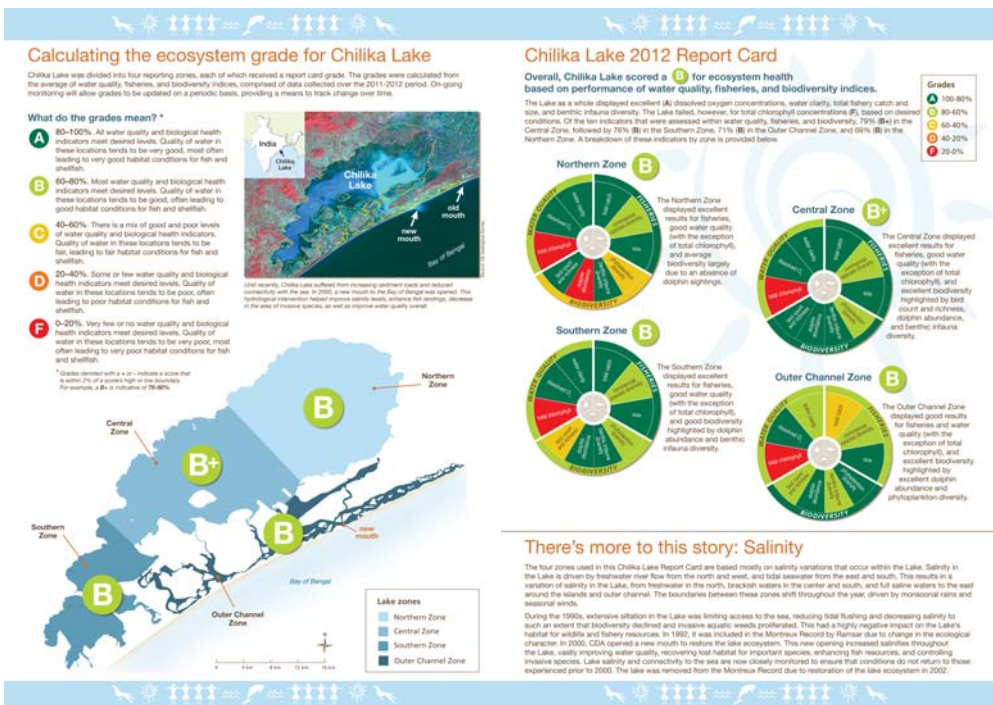
Desired conditions are based on available guidelines, current scientific knowledge, and/or historical data and trends, and take into account the influence of a variable climate from year to year. The table below outlines the desired condition developed or identified for each indicator and the source of this information.

Category	Indicator	Desired condition	Source of data
Water Quality	Water clarity	> 30 NTU	CDA
	Dissolved oxygen	> 1 mg/L or 0.16 ppm	CDA
	Total chlorophyll	< 1 µg/L	CDA
Fisheries	Total catch	% increase since or below maximum sustainable yield (11,300 t/yr)	CDA
	Commercial species diversity	Ratio of species landed/total or as desired	CDA
	Size	Proportion of species landed above a minimum size limit of 100mm TL (40 cm minimum TL, 120 mm TL, and 15 cm)	CDA
Biodiversity	Bird count and richness	Ratio to maximum bird count recorded since 2002	CDA
	Dolphin abundance	Ratio to maximum dolphin count recorded since 2002	CDA
	Phytoplankton diversity	Simpson's Index of Diversity (D')	CDA

different sectors of the lagoon in different season or/and month as well as year. Hence the Health report card helps High-level assessments based on data and science, help engage communities and provide knowledge for management. Following this methodology, so far the Ecosystem health report card has been prepared only for Chesapeake Bay, Great Barrier Reef and Gulf of Mexico. During the workshop after through discussion, the following indices were identified to be most suitable for Chilika.

1. Water Quality Index
2. Fishery Index
3. Biodiversity Index (Birds – Abundance, Irrawaddy Dolphins – Abundance, Phytoplankton Index Benthic Index)

The threshold values for each indicator were fixed for each sector and basing on which the report card can be prepared with the recent data. The grading was assigned as A, B, C, D and F with colour code Red to green. With reference to the threshold value the grading was decided for each sector as well as for the system as a whole. Apart from the grades the report card also contains purpose, methodology and information on threshold values used for the grading (Fig.x).



**Where do we go from here?**

This report card is a significant step in progressing our understanding of how human activities to **Pressure** affect the environmental condition (or **State**) of Chilika Lake within the **Pressure-State-Response (PSR)** framework for ecosystem management.

The Chilika Lake Development Authority has a **Response** plan which envisages ecosystem conservation and sustainable resource development and livelihood improvement supported by institutional development, communication, education and public policy, and institutional development as the key management response components.

The addition of this report card that assesses and monitors the **State** of Chilika Lake completes the PSR loop, and strengthens the framework that ultimately aims to reduce uncertainty in resource management decision-making for the sustainability of Chilika Lake and those that depend on it.

Key management **Response** strategies to be adopted include the following:



- Ensuring hydrological connectivity of Chilika with freshwater and coastal processes at the basin level.
- Establishing hierarchical and multiscale inventory of hydrological, ecological, socioeconomic, and institutional features and ecosystem services to support management planning and decision-making.
- Promoting sustainable catchment management practices to manage inflow of silt and nutrients into the wetland system.
- Adopting environmental flows as a basis for water allocation for conservation and development activities.
- Promoting biodiversity conservation through habitat improvement of endangered and indigenous species.
- Supporting ecotourism development for enhancing awareness, income generation, and livelihood diversification.
- Promoting sustainable fisheries for maintaining nutritional security while ensuring maintenance of biodiversity and equitable sharing of benefits.
- Reducing poverty through sustainable resource development and utilization and livelihood diversification.
- Promoting institutional arrangements enabling integration of wetland management planning and river basin and coastal zone management.
- Strengthening CIDA with adequate legal and administrative powers to regulate detrimental activities.
- Building capacity at all levels for technical and managerial skills for implementation of integrated management planning.

**Workshop participants**



**Acknowledgements**

This report card was produced with the kind support of UNEP, GPA, and other organizations.

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A Model report card indicating the health of Chilika in different zones with colour codes



# Lake Basin Management



The environmental flow assessment provided necessary clues regarding the significance of the freshwater flow from the drainage basin to maintain the ecological integrity of the lagoon. The large-scale silt flow from catchments (0.365 million cubic meters, assessed through the stream flow measurement) was identified as one of the biggest management problems. Further assessment revealed that land degradation in the drainage basin not only leads to enhanced silt flow into the lagoon but also causes poverty, due to low productivity in the drainage basin. The chief livelihood strategy adopted by the watershed community is rain-fed paddy cultivation once a year. The average annual rainfall received is 1400 millimetres, but because this average is not consistent, total or partial crop failure is a common phenomenon. Poor crop productivity had been adversely affecting the livelihood of the watershed agricultural community, consequently triggering migration in search of employment. The depletion of natural resources and loss of their productive capacity had imparted huge costs on the local communities due to declining agricultural productivity and acute shortage of water.

An innovative participatory micro-watershed management concept has been adopted with a “sustainable rural livelihood” approach for holistic management of natural resources. The drainage basin management program was conceived as a long-term participatory process. The participation of local communities and stakeholders in planning and implementing management of natural resources and in sharing the responsibilities of decision-making is a key feature of the ecosystem approach adopted for management of drainage basin. The goal has been to empower the community to manage and reverse degradation of life support systems within the watershed, particularly land and water, to enhance the productivity, resulting in alleviation of poverty and promoting improvements in livelihood of agricultural communities. To ensure the involvement of the community and sustainability, it is being ensured that the watershed community share a part of the costs of the treatment towards the watershed development fund which would be utilised for maintenance and further improvements of the watershed assets created after the project period is over. The watershed association and the user groups had been able to efficiently implement the micro-plan in consultation with the community. From the lessons learnt in the participatory catchment treatment, Chilika Development Authority has been implementing the plantation programmes and watershed programmes religiously for augmenting the catchments to reduce silt load into the Chilika. Some of the works initiated are discussed here under:

### Barren Hill Plantation

The barren hillocks around the Lake which are devoid of vegetation were identified on priority basis for restoration considering the severe erosion leading to accelerated silt load in to the lake. For treatment of the barren hills soil & moisture conservation measures were given priority along with plantation and regeneration. In 2011-12, 100 ha. severely eroded barren hill in the Western Catchment of Chilika, was treated. The sitewise details is as follows;

Sl.No.	Name of the site	Proposed area in ha.	Status of land
1	Ghantashila	30.00	Revenue land
2	Kulei	20.00	Revenue land
3	Kuhuri	20.00	Reserve Forest
4	Sunakhala	30.00	Protected Forest
<b>Total</b>		<b>100.00</b>	





### **Integrated Watershed Management Programme (IWMP)**

The Ministry of Rural Development, Government of India have formulated a common guideline for watershed development . As per this guide lines the cost norms per hectare is Rs. 12,000. The Key features of the treatment of the catchment is;

- Cluster approach i.e. treatment of 5,000-6,000 ha in each cluster.
- Ridge to valley approach with convergence through inter-departmental coordination.
- The duration of the project (treatment) is for 7 years.
- Participatory approach with the active participation of stake holders.

The Key expected outcomes include increase in water table, changes in irrigation potential & cropping pattern, wastelands to be brought under agriculture, change from single crop to multiple crops, enhance the land under the vegetation including horticulture, fuel and fodder. Enhancement of livelihood of the villagers; and empowerment of S.H.Gs and U.Gs in the watershed.

**IWMP-IV:** Under this programme 10 micro watersheds of Western catchment of the Lake comprising 44 villages in 7 grampanchayats of Banapur block of Khordha district have been selected for implementation. The treatable area is 6500 Ha. The project was sanctioned during 2010-11 by Government of India in the Ministry of Rural Development vide sanction order No.Z-11011/ 23/ 2009- PPC dated 29<sup>th</sup> October, 2010 with an approved out lay of Rs. 780.00 lakhs. Village level Participatory Rural Appraisal(PRA) and village cluster meetings have been completed. The watershed committee have been institutionalised and the preliminary works like entry point activities in the villages have been initiated. The registration of the watershed committee under the Registration of Societies Act, 1860 has been initiated. The major EPA activities have been completed. The Detailed Project Reports are in the process of finalisation. The village profile of the cluster is as follows;

### Village Profile of Cluster under IWMP-IV, Banapur Block

Sl. No	Micro watershed Code	Name of Gram Panchayat	Name of Village & Code No.	Geographical area in ha.	Treatable area in ha.	No. of House hold	SC	ST	Total Population OBC	Total	Project cost (in lakhs)
1	2	3	4	5	6	7	8	9	10	11	12
1.	0407010801090102 AndhariNala W/s	Deogaon	1. patrapur 2. Baramula	614.39	359	73 Xx	98 0	0 0	210 0	308 Xx	43.08
2.	0407010801090103 NataNala W/s	Deogaon	1. Beladihi 2. Tota 3. Bharatapur 4. Ayatapur 5. Dayanajari	762.00	590	180 95 92 329 Xx	73 0 64 296 0	15 0 0 24 0	773 481 382 2083 0	861 481 446 1763 Xx	70.8
3.	0407010801090203 HatiabandhaNala W/s	Deogaon	1. Suliapalli 2. Odagaon 3. Deogaon 4. Paladhuapalli	1018.00	1010	Xx 271 145 127	0 31 17 92	0 0 0 0	0 1464 874 582	Xx 1495 891 674	121.2
		Gahmarimunda	5. Gopinathpur 6. Torasingh			105 114	9 0	0 0	512 575	521 575	
4.	0407010801130102 JogibandhaNala W/s	Galua Narendrapur	1. Muktapur 2. Bikrampur Sasan 3. Birudi 4. Ramachandrapur 5. Samal 6. Jhadeswar	805.00	605	Xx Xx 63 49 Xx Xx	0 0 0 0 0 0	0 0 0 0 0 0	0 0 343 230 0 0	Xx Xx 343 230 Xx Xx	72.6
5.	0407010801100203 SapuaNala W/s	Gahmarimunda	1. Bhatapada 2. Thekuapalli 3. Lahangadihi	1113.00	801	474 35 76	101 0 0	130 0 0	2225 148 379	2456 148 379	96.12
6.	0407010801110201 Pandarasuni W/s	Nachuni	1. Salapadihi 2. Paikarapur 3. Moramori	1192.00	815	195 33 385	0 0 331	0 0 0	1219 174 1514	1219 174 1845	97.8
7.	0407010801110103 MaaJayadrugaNala W/s	Kulei	1. Arjunapur 2. Madhusudanpur 3. Hadakhai 4. Agadiapalli 5. Sadasibapur 6. Mansinghpur	246.00	229	Xx Xx 8 Xx Xx 57	0 0 0 0 0 21	0 0 0 0 0 0	0 0 34 0 0 0	Xx Xx 34 Xx Xx 251	27.48
8.	0407010801100201 Sentara Nala W/s	Gahmarimunda	1. Khumulamala 2. Chakadapathara 3. Karadapalli	1237.00	884	Xx Xx 107	0 0 9	0 0 0	0 0 590	Xx Xx 599	106.08
9.	0407010801110101 AjagarNala W/s	Damiabarabara Kulei	1. Raeipada 2. Dinabandhupur 3. Gotapalli 4. Manei 5. Kaluniari	1725.00	973	Xx 120 99 32 52	0 179 0 20 13	0 0 0 0 0	0 479 601 161 278	Xx 656 601 181 291	116.76
10.	0407010801100104 BadabandhaNala W/s	Deogaon Gahmarimunda	1. Jadupur 2. Ghasedihi 3. Barapatana 4. Panchugaon 5. Nachhipur	240.00	234	2 267 49 214 56	0 242 0 0 30	0 0 0 0 0	9 1169 439 1093 294	9 1411 439 1093 324	28.08
				<b>8930.39 ha.</b>	<b>6500 ha</b>	<b>3847</b>	<b>2048</b>	<b>169</b>	<b>18,351</b>	<b>20568 Nos.</b>	<b>780.00</b>

**IWMP-VI:** Under this programme 10 micro watersheds comprising of 31 villages in 8 Gram Panchayats of Ranpur Block of Nayagarh district has been selected for the treatment of watershed with a cluster approach. The total area targeted for treatment is 6600 Ha. The project was sanctioned during 2011-12 by Government of India, in the Ministry of Rural Development vide sanction order

No.K-11013/10/2011- IWMP with an approved outlay of Rs. 792.00 lakhs. Village level Participatory Rural Appraisal and village cluster meetings have been completed. The watershed committee have been institutionalised and the preliminary works like Entry point activities in the villages have been initiated. The Detailed Project Reports are in the process of finalisation. The profile of the villages in the cluster is shown as under.

### Village profile under IWMP-VI, Ranpur Block

Sl. No.	Watershed Name & Code	Name of Grampanchayat	Name of Village	Geographical area(in ha.)	Treatable area (in ha.)	No. of House hold	SC	ST	Total Population Gen	Total	Project Cost
1	Dhanipahad W/S 0407010802150502	Raipada Kerendatangi	Raipada	742.00	639.00	237	13	47	1200	1260	76.68
			Ranigadia			18	0	75	0	75	
			Gourchandrapur			156	45	0	730	775	
2	MaaKhilamunda W/S 0407010802150201	Kerendatangi Kerendatangi Kerendatangi	Nuapada	570.00	485.00	202	35	0	933	968	58.20
			Kerendatangi			159	0	0	159	871	
			Ekatala			150	9	13	728	750	
3	BeinGadiaNala W/S 0407010802150103	Kerendatangi	Muktapur Brundabanbihariapur	347.00	295.00	173 101	0 4	30 5	907 566	937 575	35.40
4	Baghamarabandhaws 0407010802160103	Kerendatangi KandhaNayagarh Champagarh	Upendrapur	991.00	842.00	70	0	141	277	418	101.04
			KandhaNayagarh			482	108	0	3544	3652	
			Benta			241	0	30	1155	1185	
5	BadajharaNala W/S 0407010802160201	Champagarh	KatakaSahar	877.00	744.00	99	8	0	538	546	89.28
			Champagarh			256	24	0	1298	1322	
			Srikrushnapur			113	15	19	747	781	
6	Bankanidhi W/S 0407010802200101	Jankia	Ostapada	988.00	840.00	160	0	0	777	777	100.80
			Krushnachandrapur			164	23	0	836	859	
			Jankia			518	306	16	2230	2552	
7	MaaSuliadevi W/S 0407010802050103	Mayurjhalia	Jokagadia	781.00	663.00	16	0	0	68	68	79.56
			Mayurjhalia			445	77	35	1919	2031	
			borabarjhar			107	71	0	474	545	
8	Baunsanai W/S 0407010802050104	Champapedi Mayurjhalia	Khandisi	920.00	783.00	171	0	125	725	850	93.96
			Barangagadia			292	67	0	1264	1331	
			Jhadapada			232	173	4	1080	1257	
9	Godijhara W/S 0407010802050202	Gopalapur	Krushnapur	711.00	618.00	96	0	14	450	464	74.16
			Bimbadharpur			44	0	0	205	205	
			A.S.Singharpur			246	204	44	945	1193	
10	Balunkeswar W/S 0407010802050201	Champapedi	Nakithana	831.00	691.00	114	0	0	114	559	82.92
			Champapedi			151	0	21	678	699	
			Paikabhuin			32	0	77	88	165	
			Nagajhar			31	0	100	0	100	
				7758.00	6600.00				6600	792.00	





# Workshops, Seminars and Events





### Lunch of Real-time water quality monitoring data buoy system in Chilika

Chilika is the first site in Asia which has deployed state of the art water monitoring technology for assessing the health status of a wetland. Data buoy control facility at Wetland Research and Training Centre (WRTC) was formally inaugurated by S.J. Bijayshree Routray, Hon'ble Minister, Forest & Environment, Government of Odisha on January 18, 2013. These data buoys as earlier mentioned have been deployed at 10 different strategic locations and transmit real-time measurements of temperature, conductivity, pH, dissolved oxygen, turbidity, chlorophyll, and blue green algae to the modelling cell located at WRTC. Data is collected every 15 mins and analyzed for spatial and temporal variation in physicochemical and biological features of the lake.



*S.J. Bijayshree Routray, Hon'ble Minister Forest & Environment launching data reception facility in WRTC*

### Ecosystem Health Report Card Workshop

A workshop on the development of Ecosystem Health Report Card was jointly organized by Chilika Development Authority and National Centre for Sustainable Coastal Management at Hotel Swosti Premium, Bhubaneswar on 4<sup>th</sup>-7<sup>th</sup> February 2013. This four day workshop was held with an objective to use biological, physical, and chemical parameters to develop a report card to assess the Chilika Lake health. Dr. Anjan Datta, Programme Coordinator, UNEP GPA, Shri. Vivek Wadekar, National Project Director, SICOM, New Delhi and Mr. Tapes Paul, Team Leader ICZMP, World Bank graced the occasion. Experts from the Integrated Application Network, University of Maryland; Dr. Heath Kesley, Dr. Simon Costanzo, and Jane Hawkey delivered technical presentations on the guidelines for choosing different indicators. More than 30 scientists and research scholars from India including representatives from World Bank, and Society for Integrated Coastal Management(SICOM) participated in this workshop.



### National workshop on Integrated Lake Basin Management

The First National Workshop on Integrated Lake Basin Management was organized by Chilika Development Authority and International Lake Environment Committee (ILEC). This three day workshop was held at hotel New Marrion, Bhubaneswar, Odisha, India from 5<sup>th</sup> -7<sup>th</sup> February 2013.

Sj. Bijayshree Routray, Hon'ble Minister, Forest & Environment, Government of Odisha was the Chief Guest in the inaugural session of the workshop. The other dignitaries viz., Sri. R.K.Sharma, IAS, Principal Secretary, Forest & Environment Department, Government of Odisha, Dr. Masahisa Nakamura, Chairperson, RCSE & ILEC, Japan, Dr. Ajit Pattnaik, IFS, Chief Executive, CDA and G. Rajesh, IFS, Additional Chief Executive, CDA graced the inaugural session of the workshop. A quarterly newsletter 'Chilika' was also released in the workshop. More than 50 participants from India and abroad including researchers and wetland managers have attended the workshops.



### Workshop on GIS and remote sensing application for Ramsar sites

Chilika Development Authority (CDA) in collaboration with Space Application Centre (SAC, ISRO) Ahmadabad organized a two-day brainstorming workshop on “*Planning the wise use of satellite remote sensing data derived information of Ramsar sites in India*”. The workshop was held at Wetland Research and Training Centre, Barkul on March 11-12, 2013. The objective of the workshop was to promote the wise use of remote sensing and GIS applications in the management of Ramsar sites of Eastern and Southern zone of India. Dr. Jai Singh Parihar, Dy. Director SAC discussed various applications of remote sensing in context to management of catchment area of Ramsar sites. Dr. Sushma Panigrahy, Ex-Scientist SAC, presented detailed insights on National Wetland Inventory and Assessment (NWIA) project supported by Ministry of Environment and Forests. A total of about 20 participants including Divisional Forest Officer, PCCF, and wetland managers from forest division of Kerala, Andhra Pradesh, Orissa, attended the workshop.



### Chilika Junior Rangers Programme

Chilika Development Authority in collaboration with “Barefoot” a leading NGO and support from the US Consulate General Office, Hyderabad launched “Chilika Junior Rangers’ Programme” on February 2, 2013 i.e. on World Wetland Day. This three days programme is aimed at introducing school children (aged 10-14) to the Lake ecosystem and about the ecosystem services the Lake provides also about its conservation needs. During the programme the school children camped on an island and were exposed and got a good exposure and 1<sup>st</sup> hand information about the lake ecosystem and lake communities. Experts from different disciplines also addressed the students and an education kit on Chilika was also released on the occasion. This was a life time experience for the School Children who attended this programme.

It is proposed to continue with this programme. The students shall LEARN, EXPLORE and PROTECT the nature. They will learn about the Irrawaddy Dolphins, bird watching, fisheries and several other aspects of the wetland conservation. Both children and adults benefit by learning more about the lake ecosystem and have the fun of becoming a Junior Ranger. The student would camp at exclusive locations on the islands of the lake and would enrich their knowledge by the inputs from the subject matter experts. On successful completion of the programme they would get the customised certificate and a rangers badge.

### **The US ambassador to India, Nancy J. Powel visited Chilika Lake**

US ambassador to India, Nancy J. Powel visited Chilika Lake on 14<sup>th</sup> January, 2013. She visited the new mouth and was accompanied by Chief Executive of Chilika Development Authority, Dr. Ajit Kumar Pattnaik.

She was shown the post restoration outputs of Chilika Lake, which has resulted in significant rise in its fish production and restoration of biodiversity. The Chief Executive of Chilika Development Authority explained that after the hydrological restoration of the lake, fish production of the Lake has increased due to enhanced natural recruitment through the newly opened mouth and the breeding migration of the fish and finfish from the Lake to the sea and vice versa.

She also saw the sensor mounted on the floating buoys that telemetrically transmit the water quality data on real time basis to the CDA laboratory, which were installed by Chilika development authority at 10 strategic locations which she appreciated. She was explained about the Dolphin watching which has emerged as an alternate source of livelihood for the fishermen of Chilika Lake. During the visit she also visited the Maggarmukh to observe the Irrawady dolphins. Later on she visited the visitor Centre of CDA, located at Satapada which showcases the entire lake ecosystem. She saw the documentary on restoration and management of Chilika Lake.

### **Irrawaddy Dolphin population on an increase in Chilika**

The Irrawaddy Dolphin Census in Chilika carried on January 19, 2013 indicates that their population has increased to 152 as against 145 recorded during the 2012 census.

Of the 152 individuals sighted, 118 are adults, 16 sub- adults and 18-calves and neonates. For the first time, 8 sighting were reported from the Northern Sector, an indication of their expanding habitat within the wetland. The increase in population is due to an increase in number of calves and neonates to 18 from the last years' 11 sightings.

The population survey was conducted using the globally practiced line transect method. 18 survey transects were covered, with a team, including three experts assigned to each. The survey was carried out by 130 participants from State Government's Wildlife Wing Officials and Animal Resource Development Department; Honorary Wildfire Wardens; Chilika Wildlife Division; officials from WWF- India; BNHS; NGOs ; researchers and academicians from the University and colleges; Wildlife Society of Odisha; Geovitech, Bhubaneswar; Regional Plant Resource Center; Elektronika Lab; State Project Management Unit, Integrated Coastal Zone Management Project; Peoples for Animals; Chilika Development Authority, and members of local Motor Boat Associations.

The survey was carried out from 6.30AM to 4.00PM on January 19, 2013 in the dolphin habitat of the Chilika lagoon. The first attempt on January 7 – 8 had to be abandoned due to low visibility and high velocity winds. Training to participants was held at Wetland Research & Training Center, Chandraput and Visitor Centre, Satapada in the afternoon of 18<sup>th</sup> January, 2013.

The local motorboat associations in a unique expression of solidarity to the survey process did not operate their boats during the census period.



It is noteworthy that Chilika is a natural abode of highly endangered Irrawaddy dolphins (*Orcaella brevirostris*). The present distribution range of this species is only in Asia i.e. from Chilika to Indonesia within South East Asia and South Asia. Their total global population is estimated to be less than 7500 (highest 6400 reported from Bangladesh). The population in Chilika is considered to be the highest single lagoonal population.

Chilika Development Authority has initiated many conservation measures for the protection and conservation of Irrawaddy dolphins in Chilika in close coordination with Wildlife wing of State Forest Department such as: (1) Survey and identification of dolphin habitat in the lagoon for proper management, (2) Development of dolphin watching protocol for safe watching of dolphins, (3) Sensitization and training of tourist boat operators, (4) Widening and deepening of Magarmukh channel for free movement of dolphins from Outer channel to the main lagoon, (5) Acoustic survey of underwater behavior of dolphins through deployment of hydro phones in collaboration with Tokyo University.

Sector	Adults	Sub-adults	Calves/Neonate	Total
Central Sector	23	5	7	35
Southern Sector	25	4	6	35
Outer channel	63	6	5	74
Northern Sector	7	1	-	8
<b>Total</b>	<b>118</b>	<b>16</b>	<b>18</b>	<b>152</b>

## 2<sup>nd</sup> Workshop on wetland management planning

Chilika Development Authority and Wetland International-South Asia (WISA) organized a two day training workshop for the wetland managers on Jan 2<sup>nd</sup>-3<sup>rd</sup>, 2013 at Wetland Research and Training Centre. The workshop was aimed at providing second level training to divisional forest officers and wetland managers for formulating a sustainable wetland management plan, this was conceptualized and framed based on the need based assessment made from the outcomes of the first similar workshop. The workshop contained several interactive sessions which included presentations on (i) Wetland management planning – an introduction (ii) Wetland management planning methodology, and (iii) Wetland wise use and ecological character. Using specific case studies of wetlands, Dr. Ritesh Kumar, Conservation Programme Manager WISA, demonstrated key points which are crucial for the development of a good wetland management plan. Participants of the training workshops also discussed the draft management plans and recommendations by the experts were suggested during the training. The participants were provided with resource material on Wetland Management and Planning.

## Management Planning Workshop 20<sup>th</sup> October 2012

Chilika Lake was included in the Montreux Record in 1993 due to change in its ecological characters. Considering the urgency, CDA formulated an adoptive action plan, based on the targeted studies carried out by the premier institutes of the country. By way of implementation of the action plan CDA took some programmatic steps for restoration of the lake and Chilika was removed from Montreux Record in 2002. The Ramsar Convention Secretariat supported Wetlands International-South Asia (WISA), New Delhi, for formulation of a long-term management plan for Chilika based on the Ramsar guidelines. WISA in consultation with the key institutions and stakeholders have formulated a draft integrated management plan for Chilika following the Ramsar guidelines. The format of the management plan is designed by a number of experts, scientists and organization, who have been

working on various issues and aspects of Chilika lagoon through the years. Management planning exercise also involved wide scale stakeholders' consultation. The management plan was released by Hon'ble Chief Minister of Orissa and Chairman, CDA during the one day "Workshop on Management Planning of Chilika" on 20th October 2012 at Hotel Mayfair Lagoon, Jaydev Vihar Bhubaneswar, Odisha in presence of Dr. Anada Tiega, Secretary General, Ramsar Convention Secretariat and Sj. Bijayshree Routray, Minister, Forest & Environment Department, Government of Odisha., Sj. Pinaki Mishra, Hon'ble Member of Parliament, Puri, Dr. (Prof) Prasana Kumar Patsani, Hon'ble Member of Parliament, Bhubaneswar, Sj. Sanjay Das Burma, Deputy Chief Whip and Hon'ble Member Odisha Legislative Assembly, Brahamgiri, Sj. Raghunath Sahu, Hon'ble Member Odisha Legislatively Assembly, Chilika, Sri R.K. Sharma, IAS, Principal Secretary, Forest & Environment Department, Government of Odisha and Dr. A.K. Pattnaik, IFS, Chief Executive Chilika Development Authority. After the release of Management Planning Framework of Chilika Lake there was a panel of discussion on the management planning.

Formulation of the management planning framework was led by Wetlands International South Asia and Chilika Development Authority. A team of experts from Institute of Land, Water and Society, Charles Sturt University (Australia); Karunya University (Coimbatore); Xavier Institute of Management, (Bhubaneswar); Bombay Natural History Society (Mumbai), and Central Inland Fisheries Research Institute (West Bengal) provided the expert review and advisory support to the planning process. Financial support for the plan was provided by Ramsar Convention Secretariat (Switzerland) and International Development Research Center (South Asia Regional Office, New Delhi).

The management plan framework outlines strategies and actions required to achieve wise use of Chilika and thereby ensure conservation of its rich biodiversity and related ecosystem components and processes as well as livelihoods of dependent communities. An extensive review of scientific information as well as stakeholder consultations, particularly with local communities formed key inputs to plan formulation. A draft framework of the plan was reviewed in a consultation workshop held in October 2009. The plan also includes a strategy for institutional reorganization of Chilika Development Authority to enhance its effectiveness, particularly in linking management of Chilika to river basin and coastal zone management. The document is based on the technical guidelines provided by the Ramsar Convention Secretariat and Ministry of Environment and Forests, Government of India.

The evaluation of wetland features carried as a part of the plan document has highlighted several positive changes in the wetland ecosystem particularly after the hydrological intervention of September 2000. The overall biodiversity and ecological productivity of the wetland system has been enhanced as is indicated by increasing population and habitat use by Irrawaddy Dolphins; presence of sizeable population of water birds, particularly intercontinental migrants; rich fish diversity; and increase in sea grass beds. The overall fish catch has been maintained since the last decade at 12,000 MT, which is the source of livelihood of a large population of fishers. However, there are challenges in the form of invasive species, silt loads particularly from Mahanadi Delta, nutrient enrichment and an inequitable benefit sharing pattern in fisheries sector. The impacts of climate change would also need to be factored in at an early stage to ensure that the management is able to respond adequately.

#### **Chilika at the side events at the Convention on Biological Diversities CoP11 at Hyderabad**

The eleventh conference, widely known as CoP11 was hosted by India and organized at Hyderabad from 1-19 October, 2012. The convention was attended by more than 8000 delegates from 193 member countries. The NCSCM, Ministry of Environment & Forest, SICOM & Chilika Development Authority & Integrated Coastal Zone Management Project, SPMU, Odisha, organised one of the

major side events of the CoP11 i.e. “Lagoons, Lives and Livelihoods” on 15th October 2012. A documentary on the ‘restoration of Chilika lagoon with an ecosystem approach “A new lease of life” was premiered during the event. The Project Director of the Integrated Coastal Zone Management Project (ICZMP) - Odisha led the delegation in the side events named “Lagoons, Lives and Livelihoods” and briefed the panel on the people’s participation in biodiversity conservation and wise use of natural resources at Chilika. The event was inaugurated by Smt. Jaynathi Natarajan, Hon’ble Environment & Forests Minister, Government of India. The eminent Panelist were Prof K. Kasturirangan, Member, Planning Commission, Dr. Anada Tiéga, Secretary General, Ramsar Convention Secretariat, Dr. Shailesh Nayak, Secretary, Ministry of Earth Sciences, Secretary Ministry of Forest & Environment, Dr. Ajit Pattnaik, Chief Executive of Chilika Development Authority and PD, ICZMP – Odisha, Prof. Alice Newton, Norwegian Institute for Air Research (NILU) and Shri Vivek Wadekar, National Project Director of SICOM, Prof. R. Ramesh, Director, NCSCM along with the local communities from Chilika lagoon.

The panel widely discussed on the need to strengthen ecosystem and community based management strategies. Panelists discussed on the successful restoration of Chilika Lake with ecosystem approach that led to amelioration of the lake ecosystem and enhanced productivity that immensely benefited the local communities. The case study on Chilika was also highlighted in the side event on Water, Wetlands and Aichi Targets, organized by Wetlands International South Asia on October 9, 2012. The side event aimed at developing concrete and practical recommendations for enhancing recognition of integrated water management as a means of achieving conservation of inland waters and meeting the related targets under the CBD Strategic Plan 2011-2020. Over 40 participants representing Ramsar Convention, CBD Secretariat, national delegates, development banks, representatives of non-governmental organizations and media attended. The presentations and discussions held conclusively underlined that integration of wetlands within water management underpins success in achieving the Aichi targets. This was currently being undermined by lack of emphasis on the co-benefits that the two sector could achieve by working together. Expressing the values of wetland ecosystems would be one of the important means of cross sectoral communication.

### **Expert Group Meeting to develop indicators to assess coastal ecosystem health 25- 27 June 2012**

Chilika Development Authority and National Center for Sustainable Coastal Management (NCSCM), Ministry of Environment & Forests, Government of India in collaboration with United Nations Environmental Programme (UNEP), organised an ‘Expert Group Meeting to develop indicators to assess coastal ecosystem health’ under ‘Global Partnerships on Nutrient Management Programme (GPNM)’ from 25th June to 27th June 2012 at Wetland Research & Training Center, Barkul, Odisha, India. The consultation meeting focussed on the methodology for development of the report card system in Chilika Lake. Dr. Anjan Datta, the Programme Officer and the Officer-in-Charge of the UNEP/GPA Coordination Office, Nairobi, Dr. Robert Jara, Coordinator, PEMSEA, Manila and Adelina C. Santos-Borja from Laguna-de-Bay, Philippines along with the experts from leading institutes from India participated in the above meeting. The Small Scale Funding (SSF) of the UNEP had sanctioned 1,18,000 US Dollar for developing the card system project. The Lake monitoring data including the water quality, sediment, macrophytes and biota would be generated to a scoring system. The project is aimed to define basic indicators and values to ascertain the health of the Chilika Lake.

### **11<sup>th</sup> Governing Body Meeting**

11th Governing Body meeting of Chilika Development Authority was held on 18th June 2012 at 11.30AM under the Chairmanship of S.J. Naveen Pattnaik, Hon’ble Chief Minister, Odisha. Hon’ble



Chief Minister made a brief statement on the activities carried out by Chilika Development Authority and the adverse effects of prawn gheries on the brackish water lagoon's ecosystem as well as the livelihood of fishermen living in and around the lake were discussed. A number of important decisions were taken. The Annual Report 2010-11 of CDA, 'Chilika Wetland Education Kit' and the quarterly published newsletter 'Chilika' also released by the Hon'ble Chief Minister, Odisha.

### **1<sup>st</sup> Training cum Workshop for Wetland Managers**

Chilika Development Authority and Odisha Wetland Development Authority (OWDA) organized a two day training workshop for the wetland managers on Jan 2<sup>nd</sup>-3<sup>rd</sup>, 2012 at Wetland Research and Training Centre. This workshop was technically supported by Wetland International-South Asia (WISA). This workshop was aimed at providing training to Divisional Forest Officers and wetland managers for formulating a sustainable wetland management plan for the identified wetlands. The workshop comprised several interactive sessions which included presentations on (i) Wetland management planning – an introduction (ii) Wetland management planning methodology, and (iii) Wetland wise use and ecological character. Using specific case studies of wetlands, Dr. Ritesh Kumar, Conservation Programme Manager WISA, demonstrated key points which are crucial for the development of a good wetland management plan. Participants of the training workshops also discussed the site specific issues of the identified wetlands and made draft management plans as per the recommendations suggested during the training. The participants were provided with resource material on Wetland Management and Planning.

### **Inception Workshop on 'Strengthening livelihood resilience to changing climate in Chilika Lagoon, India'**

Chilika Development Authority (CDA) and Wetlands International – South Asia (WISA) launched a three year research initiative on Climate Change in Chilika. This was declared during inception workshop held on 1st-3rd December, 2011 at Wetland Research and Training Center, Barkul. The three year initiative titled 'Strengthening livelihood resilience to changing climate in Chilika Lagoon, India' aims to enhance climate preparedness of wetland management through developing response options and strategies for reducing climate related risks as well as increasing community preparedness for changes in wetland ecosystem services. The project is supported under the Climate Change and Water Programme of International Development and Research Center (IDRC). Implementation will be jointly coordinated by WISA and CDA, with expert support from the Institute of Land, Water and Society, Charles Sturt University, Australia. Implementation will build on climate scenarios modelling, participatory risk assessments with Chilika communities, stakeholder consultations, capacity building and communication and outreach. This initiative is first of its kind to be implemented for a wetland system and would be of immense use to wetland managers in the country.

### **INDO-SWISS Science Workshop at WRTC, Barkul**

Chilika Development Authority (CDA) in collaboration with SWISS Embassy & KIIT School of Biotechnology organized a two day international science workshop on "Ecology and Conservation of Chilika Lake" at Wetland Research and Training Centre (WRTC), Barkul on 25th November 2011. His Excellency Mr. Philippe Welti, Swiss Ambassador to India, New Delhi formally inaugurated the science workshop on 25th November 2011 at WRTC, Barkul in the presence of Dr. Mattia Celio, Science & Technology Counselor from Swiss Embassy, New Delhi, Dr. Ajit Kumar Pattnaik, Chief Executive of Chilika Development Authority, Govt of Odisha and Dr. Mrutunjaya Suar, Chief of KIIT School of Bio-technology. The workshop was organized for two days from 25th to 26th November by CDA in collaboration with the Embassy of Switzerland in India and KIIT University, Bhubaneswar.



## Secretary General Visit





The Secretary-General, Ramsar Convention, Switzerland, Dr Anada, Tiega, visited Chilika Lake from 19 October to 22 October 2012. This was the first ever visit of Secretary-General Ramsar Convention to India. During the 4 days visit he made extensive tour to Chilika Lake and interacted with the local communities, stakeholders and saw various activities of CDA. He also witnessed the release of the “management plan of Chilika Lake” formulated based on the Ramsar guidelines by wetlands International on 20th October 2012 by Honorable Chief Minister & Chairman Chilika Development Authority.

The management plan is formulated by wetlands International being funded by a Ramsar secretariat. While appreciating the management plan of Chilika he mentioned that it would be used as a template for other Ramsar sites globally. In the press meet he mentioned that Chilika Lake demonstrates successful application of the various Ramsar guidelines, and the use of the Convention’s tools and approaches, to address complex wetland and catchment management issues. The management plan formulated for Chilika lake is based on the Ramsar guidelines and the lesson learnt so far.





He further mentioned that successful restoration of Chilika Lake a Ramsar site is a perfect example of how the restoration of a wetland with most appropriate strategy can not only restore the ecosystem of the wetland, but also, can contribute significantly towards the improvement of livelihood of local community due to increase in the productivity. This could be possible due to strategic planning and active participation of local communities. Thus, the inter-twinning of community-based management with science and technology and better understanding and appreciation of ecological goods and services are highly essential to conserve lake biodiversity and promote sustainable use.

The eco-restoration of the lake is reckoned as a role model for other wetlands world over. The restoration approach adopted by Chilika Development Authority is emerging as most appropriate and successful wetland restoration model for coastal wetlands within the country as well as the region. The core value of the restoration model is its global relevance.

Secretary General in his communication to the Hon'ble Minister Environment & Forest, Government of India, Hon'ble Chief Minister Odisha & Minister Forest & Environment Government of Odisha has acknowledged the policy support and the initiative to implement the Ramsar guidelines to successfully restore and manage the lake which has emerged as a global example.





CONVENTION ON WETLANDS  
CONVENTION SUR LES ZONES HUMIDES  
CONVENCIÓN SOBRE LOS HUMEDALES  
(Ramsar, Iran, 1971)

From the Secretary General

Dr Ajit K. Pattnaik  
Chief Executive Officer  
Chilika Development Authority  
C-11, BJB Nagar  
Bhubaneswar 751 014, Orissa  
India

Gland, 31 October 2012  
Ref. ANT/mik

Dear Dr Pattnaik,

Thanks to your warm hospitality and to the excellent organization, my visit to Chilika has been a wonderful and worthwhile experience.

I have learnt much and I have been extremely impressed by the demonstration of restoration of a complex and large wetland that you have achieved. Please also thank, on my behalf, your staff and in particular your wonderful team of dedicated scientists.

The meetings that were organized with key officials and local communities were very informative. I was also very impressed by the training given in schools on wetlands values and functions and by the sustainable approach taken to the development of tourism.

Finally, I would like to express my appreciation for your personal engagement and for your warm welcome. I look forward to hearing further news of the Chilika success story.

Yours sincerely,

Anada Tiéga

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