About the Authors

Dr. Jnanendra Rath, born on 1976, in Belapada of Bolangir District of Orissa state, was awarded Ph.D. degree of Utkal University in 2003 for his work on “Ecophysiological studies on algae of Chilika lake, East coast of India”. This book is the product of his work on algae of Chilika lagoon. He has vast experience in the field of wetland management particularly on biodiversity and utilization of economically important algae as well as higher plants. He developed a data base on seaweeds of India under the project “Digitised Inventory of Marine Resources: Seaweeds”. Presently he is working as a Research Associate in Regional Research Laboratory, Bhubaneswar under the National Project on “Coastal Ocean Monitoring and Prediction Systems”, sponsored by Department of Ocean Development, Government of India. He published several scientific papers in well cited journals. Dr. Rath has a hobby on wildlife and nature photography. His aim in science is to work extensively on conservation of biodiversity of wetlands and coastal ecosystems of India. Contact: jnanendra01@hotmail.com

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Chilika, the largest brackish water lagoon in Asia along the Orissa coast, attracts largest concentration of migratory waterfowl found anywhere in the Indian subcontinent. It is also famed for its fishery resources. It harbours an assemblage of marine, brackish and fresh water biota and on account of its rich biodiversity, Chilika was one of the two sites to be listed first as Internationally important wetland under the Ramsar Convention in the year 1981.

Though algal flora of Chilika lake has been studied several times during this century, most of these works were repetitive in nature. None of the authors have studied the algae of the lagoon in every season covering the entire catchment area in a particular year. Hence it was essential to survey the lake for algal forms occurring in different seasons in several collection trips so as to prepare an authentic algal distribution map of the lake. This book presents a detail account of algae of the lagoon collected during the year 1999 to 2001, documented with microphotographs and cameralucida diagrams and identified by us. The taxonomic account of these algal forms has also been given. Besides the documentation of algal forms, resource mapping and biomass estimation of economically important algal species in different salinity gradients of the lake was carried out for the first time and presented in this book. Viable protocol for agar-agar extraction from *Gracilaria verrucosa* occurring in the lake and its possible commercial exploitation is also given. Details of algal forms with descriptions, photographs, line diagrams and the site of occurrence of each species in Chilika lake can be used as a monograph for future study of algae of Chilika lake and other wetlands else where. In addition, the book can serve as a valuable document containing base line data to evaluate the potential algal resources of the lagoon and to develop management strategies while assessing the biodiversity changes in the lake during the years to come.

Dr. Jnanendra Rath
Dr. Siba Prasad Adhikary
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Chapter 1

Chilika and Its Biodiversity

Wetlands, encompassing a wide range of inland, coastal, and marine habitats are complex ecosystems sharing the characteristics of both wet and dry environment. Although occupying only 6 per cent of the world’s surface they exhibit enormous diversity (contribute more than 20 per cent of the world’s taxa and genetic resources) based on their genesis, geographical locations, hydrological regimes and substrate factors. The natural functions and rich biodiversity of wetlands gives them an intrinsic value as important as their value to human kind and their real and potential value for exploitation.

Chilika, one of the prominent wetland of India is also the largest brackish water lagoon in Asia situated in the east coast of our country between 19°28’ and 19°54’ N latitude and 85°05’ and 85°38’E longitude (Plate 1). It is spread over Puri, Khurda and Ganjam districts of Orissa. The lagoon is an estuarine one and supports an unique assemblage of marine, brackish water and fresh water species. It is connected with Bay of Bengal on its eastern side through an outlet, which cuts through liner spit that separates the lake from the sea. On the south-western side, the lake is walled by a range of hills and to the north itself in shallow sedge banks and islands just peeping above the surface. Hammmed in between the mountains and the sea, Chilika spreads itself out into a peer-shaped expanse of water. Of these Badakuda, Sanakuda, Nalabana, Kalijai, Ghantasila, Chadheiguha, Arakhakuda and Kankadakuda etc. deserve special mention. The lake receives fresh water from the river Daya and Bhargavi, one of the deltaic branches of river Mahanadi and also from several local streams. Kalijai temple, the abode of the presiding deity of the lake is located on a tiny island that is frequented by large numbers of tourist all round the year. The largest island of the lake, Nalabana is the home of several varieties of migratory water fowl not found any where in the Indian sub-continent. Chilika is known in particular for the large flocks of migratory water fowl that visit the lake from as far as the Caspian sea, lake Baikal, Aral sea, remote parts of Russia, Kirghiz steppes of Mongolia, Central, and south Asia, Ladakh and the Himalayas. The lagoon is the life line for more than 1.5 lakh stake holders who live in and around the lagoon and rely upon the lake’s supply of fish stock and other allied activities. Based on its rich biodiversity and socio-economic importance, Chilika has been designated as a wetland of International Importance and included as one of the first two wetlands under the Ramsar convention in 1981. It is included in the list of wetlands selected for intensive conservation and management by the Ministry of Environment and Forest, Govt. of India and also identified as a priority site for conservation and management by the National wetland, mangrove and coral reef committee of the Ministry of Environment and Forest.

1.1 General Features of Chilika Lake

The pear shaped lagoon has a maximum length of 64.3 km and average width of 20 km. The water-spread area varies between 906 to 1105 km² during summer to monsoon and the water depth in general fluctuates between 0.38 to 4.2 meter. Geographically the lake is circumscribed by (i) rocky hills of eastern ghat along the western and southern margin (ii) a sixty km stretch of coastal barrier along Bay of Bengal in the eastern side, and (iii) the deltic plains of Mahanadi river in the northern part. Several islands are located in the lagoon covering an area of 223 km², which include hills situated both inside the lagoon and around the lagoon. Bramagiri, Kanas and Krushnaprasad blocks of Puri district surrounds Chilika. Krushnaprasad is the largest block in the lagoon. A 35 km long, narrow, outer channel connects the main lagoon to the Bay of Bengal near the village Motto. High tide near this inlet mouth drives in salt water through the channel during the dry months, from December...
to June. With onset of the rain, the rivers falls into the Northern zone are in spate, causing fresh water currents that gradually push the sea water out. As a result of these dynamics, the inlet mouth constantly changes its position. The inlet channel is connected with Chilika at Magarmukh. The other connection with the Bay of Bengal is through Palur canal on the south-eastern side.

Because of the peculiar hydrology of the lake, salinity ranges and gradients are not uniform but vary with site and season. The various natural sources, reservoirs and sinks that regulate the Chilika lagoon system have been presented in Fig. 1.1. During the monsoon the salinity is the lowest and is the highest in the late winter and summer. The varying salinity regime and depth divides the lake into four natural sectors, viz. Northern sector, Central sector, Southern sector, and the Outer channel sector. The rivers Daya and Bhargavi fall into Chilika in the Northern sector, which supply major fresh water input to the lake during monsoon and post monsoon period which contributes about 275,000 cusecs of fresh water to the Northern sector. This zone is relatively shallow (0.5 to 1 m) due to sediment deposits carried by these two rivers and has a salinity ranging between 0 to 10 ppt. During the monsoons (July-September), the river Daya is in spate and the water level of the lake is the highest with an average depth of 3 meters. In this sector current generated by the river out flow is directed towards the sea. The Central sector is deeper than the Northern sector with medium salinity level 5 to 20 ppt and a depth of about 1.5 to 2.5 m. The Southern sector is the deepest of about 2.5 to 3.5 m and has the highest salinity concentration with less fluctuation of salinity from 10 to 20 ppt. The river Rushikulya falls in to the Bay of Bengal close to the Southern sector while the Palur canal connects it to the sea. The fourth zone is the main mouth of Chilika lake along with the 35 km long channel called the Outer channel (salinity up to 32 ppt). It starts from the lake at Magarmukh near village Satapada, and is connected to the sea near Arakhakuda. During the monsoon season, excess fresh water input from the rivers is discharged to the sea, while during the summer (April-June) when the water level is low seawater flows into the lake. This unique spatial and temporal salinity gradient of Chilika lake gives rise to a multitude of niches inhabited by a large diversity of plant and animal species, hence is one of the hotspot of biodiversity of the country (Plate 1).

1.2 Origin and History of the Lagoon

Legend and geology provide interesting contrasts in their versions of the history of Chilika. Many ancient texts mention the Southern sector of Chilika as being a major harbor for maritime commerce, back in the days when the king of Kalinga was known as lord of the sea. Indeed some rocks in the Southern sector are marked by a band of white formed by remains of corals (which are exclusively marine). This band is at a height of 8 meter above the current water level, a clear indication that the area was once marine.

Geological studies tell us that the coastline extended along the western shores of Chilika in the Pleistocene era, and that the entire north-eastern region above Chilika was under the sea. Since then, the coastline has moved considerably eastward (Chatterjee and Goswami, 1966). Similarly, the Konark temple, built on the seashore a few hundred years ago is now over 3 km from the coast. Most of the lagoons seen today were formed as a result of a world wide rise in

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**Fig. 1.1: Natural Sources, Reservoirs and Sinks for the Chilika Lake System**

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