

was not recorded during the last two decades of the coastal waters monitoring programme of the institute. The nitrite–nitrogen was found to be similar to that of 2004 (except at 15 m depth) but was higher than that in 2003. The nitrate–nitrogen concentration during January 2005 showed higher values in comparison with those in previous years and the values fluctuated from 6.69 to 10.15  $\mu\text{g at/l}$ , while during January 2003 and 2004 the values fluctuated from 0.65 to 4.75  $\mu\text{g at/l}$  and 1.30 to 6.58  $\mu\text{g at/l}$  respectively. The silicate concentration, contrary to other nutrients, exhibited a lower range in January 2005 compared to that in earlier years.

The present observation (January 2005) indicated a drastic change in the coastal water quality of Thannirbhavi and Chitrapur region even while comparing with the observation made on 7 December 2004 three weeks before the tsunami. During that time, the coastal water temperature ranged from 27.60°C to 28.00°C, pH from

7.82 to 8.11, dissolved oxygen from 4.12 to 5.12 ml/l, salinity from 31.76 to 32.98 ppt, phosphate–phosphorus from 1.07 to 4.32  $\mu\text{g at/l}$ , nitrite–nitrogen from 0.76 to 1.23  $\mu\text{g at/l}$ , nitrate from 3.50 to 7.28  $\mu\text{g at/l}$  and silicate from 8.17 to 20.27  $\mu\text{g at/l}$ .

Along the west coast of India, the presence of high salinity, low dissolved oxygen and nutrient-rich waters has been reported during south-west monsoon seasons, when subsurface water reaches the coastal zone due to upwelling<sup>1</sup>. However, water during January 2005 along the Dakshina Kannada coast exhibited high salinity, low dissolved oxygen and high nutrient characteristics indicating the impact of tsunami on the characteristics of coastal waters.

The study revealed a drastic change in the coastal water quality due to the tsunami that has brought a nutrient-rich deeper waters into the coastal areas around the Indian subcontinent. These may further result in increased primary and secondary

production and change in the coastal biodiversity.

1. Sankaranarayanan, V. N. and Jayaraman, N. R., *Curr. Sci.*, 1972, **41**, 204–205.

ACKNOWLEDGEMENT. We thank Mr Praveen and crewmembers of *M.F.V Nethravathi* for their kind cooperation during the water sample collection.

H. R. V. REDDY\*  
R. J. KATTI  
K. P. RAVEESHA  
CHANDRASHEKARA  
S. J. VIKAS  
R. S. NAGENDRA BABU  
K. S. SHIVA KUMAR

Department of Fisheries,  
Environment and Ecology,  
College of Fisheries,  
Mangalore 575 002, India  
\*e-mail: hrvreddy@yahoo.co.in

## Habitat heterogeneity of the Loktak lake, Manipur

An important feature of present-day Indian wetlands is that many natural lakes and rivers are progressively being degraded and many man-made wetlands such as reservoirs and canals have become increasingly more prominent. However, natural wetlands are still one of the world's most productive ecosystems and they support valuable biodiversity, including habitat diversity or heterogeneity. Here we describe the six habitat patches of the Loktak lake (24°25'–24°42'N; 93°46'–93°55'E), a Ramsar site (recently added to the Montreux record) which is the largest natural lake in eastern India (289 km<sup>2</sup>). The lake has a unique ecosystem called 'phoomdi' (a Manipuri word meaning floating mats of soil and vegetation). The largest among the phoomdis in the Loktak lake is the Keibul Lamjao National Park (40.5 km<sup>2</sup>), which is home to the Sangai, the Manipuri brow-antlered deer (*Cervus eldi eldi*), which is on the brink of extinction<sup>1</sup>. The lake is also the only means of sustenance for the wildlife and people who live on the phoomdis.

Since much of the study area has long been inaccessible to ornithologists for political and logistical reasons, little is known about the birds in this area. This is a report

from the wetland area describing the habitat diversity from the avifauna point of view.

The phoomdi habitat is spreading rapidly, forming more than 70% of the total area of the lake and thereby threatening the whole ecosystem of the lake (Figure 1). The most probable reason for this spreading of phoomdi is the damming of the lake, which has stopped the natural process of removal of old phoomdis that used to float (piece by piece) out of the lake through outlets to the Manipur River. Phoomdis are a heterogeneous mass of soil, vegetation



Figure 1. Phoomdis choking the Loktak lake.

and organic matter in different stages of decay. Important vegetation of the phoomdis includes *Eicchornia crassipes*, *Phragmites karka*, *Oryza sativa*, *Zizania latifolia*, *Cynodon* spp., *Limnophila* spp., *Sagittaria* spp., *Saccharum latifolium*, *Erianthus pucerus*, *Erianthus ravennae*, *Lersia hexandra*, *Carex* spp., etc. the most dominant species being *P. karka*.

The second habitat patch is the area with rooted floating plants which includes *Nelumbo nucifera*, *Trapa natans*, *Euryale ferox*, *Nymphaea alba*, *N. nouchali*, *N. stellata* and *Nymphoides indica*. These habitat patches are getting lost rapidly due to phoomdi proliferations. As a result birds such as *Hydrophasianus chirurgus*, *Metopidius indicus*, etc. reported to be abundant in the area<sup>2</sup> have shown a declining trend<sup>3</sup>.

Phoomdi proliferations also threaten the third habitat patches, i.e. open-water areas where the main activities of most waterfowls, including dabbling and diving ducks take place. They mostly occur in the central part of the lake.

Small hillocks in the lake are now heavily populated, as a result of which the natural habitat of the area is being degraded.

## CORRESPONDENCE

However, big trees in these areas have been observed to be occupied mostly by birds of prey such as *Milvus migrans lineatus* and *Circus aeruginosus*.

The peripheral shallow water areas have been lost forever due to the damming of the lake. Birds such as storks, pelicans and cranes have also disappeared. *Ephippiorhynchus asiaticus*, *Ciconia ciconia*, *Anastomus oscitans*, *Leptoptilos dubius*, *Grus monachus*, *Grus antigone* and *Pelecanus javanicus* were found abundantly in the study site before damming<sup>2</sup>. During our survey of the Loktak subdivision and its adjoining areas of the Loktak lake conducted from January 2000 to December 2002, none of the birds mentioned above were recorded. Only 41 individuals of *Pelecanus philipensis* (which used to occur in thousands at the lake)<sup>2</sup> were recorded in the three years survey. The ecological changes due to damming have resulted in the dis-

appearance of over 16 indigenous species of fish and 20 species of economically important aquatic plants<sup>4</sup>.

Peripheral dyke fish-farming areas are newly developed ones. The most important feature of this habitat patch is its potential to replace the lost shallow water habitat patch. With suitable spots being developed, many of the lost birds are expected to revisit the lake. However, unlike the lost shallow-water habitat areas, these newly developed areas are not natural but are man-managed. Thus new conflicts between man and the birds for possession of resources (i.e. fishes in the ponds in this case) cannot be ruled out.

Thus the Loktak lake has varied habitat patches (habitat heterogeneity) supporting a rich biodiversity. However, much work is to be done on the distribution and taxonomy of flora and fauna of this relatively unexplored geographical area.

1. Gee, E. P., *J. Bombay Nat. Hist. Soc.*, 1960, **57**, 597–617.
2. Hume, A. O., *Stray Feathers*, 1888, **11**, 1–353.
3. Sanjit, L., Ph D thesis, Gurukula Kangri University, Harwar, 2004.
4. Manraj, G., *The Sangai Express*, 4 February 2000.

LAISHANGBAM SANJIT  
DINESH BHATT\*  
ROMESH KUMAR SHARMA

*Avian Biodiversity and Bioacoustics Lab,  
Department of Zoology and  
Environmental Sciences,  
Gurukul Kangri University,  
Harwar 249 404, India  
\*e-mail: dd\_bhattach@yahoo.com*

## NEWS

### Borlaug award for Dr S. Nagarajan

Dr Subrahmaniam Nagarajan, Director, Indian Agricultural Research Institute, New Delhi has been selected for this year's Borlaug award (2004–2005). The award was instituted by Coromandel Fertilizers Ltd in honour of Dr Norman E. Borlaug, a well-known agricultural scientist, responsible for initiating the Green Revolution in India.

Nagarajan (born November 1945) is a distinguished scientist in the field of

wheat pathology and wheat improvement.

He is currently the acting Chairperson of the Agriculture Biotechnology Committee; and Monitoring and Evaluation Committee (MEC) of the Department of Biotechnology on transgenic crops; Co-Chairman of RCGM and Member SAO(O) of the Department of Biotechnology; Member of the Indo-US working group on

Biotechnology and Indo-French working group on Agriculture; Board of Management Member, National Dairy Research Institute and Indian Veterinary Research Institute. As Director of IARI, he developed the vision document and re-set the research agenda making a shift from production-oriented research to quality improvement, value addition and market-oriented research.

## MEETING REPORTS

### Recent advances in mycology\*

Basic and applied aspects of mycological research are the major concerns in many universities and institutes of India. The National Seminar on Recent Advances in Mycology (NSRAM) conducted in collaboration with the 31st annual meeting of the Mycological Society of India (MSI) provided a forum to discuss the rapidly expand-

ing areas of mycology. About 175 delegates belonging to 20 universities and 10 national institutions participated in the seminar.

Topics on eight broad areas covered in the seminar were: Fungal systematics and biodiversity; Fungi as food, fuel and fertilizer; Fungal interactions with plants and animals; Fungal pathogens of plants and animals; Fungal pesticides and biological control; Fungal bioactive metabolites, and biotechnology; Environmental mycology and Novel techniques and ideas in mycology.

The two-day deliberations consisted of three invited talks, 14 lead lectures, 29 oral and 47 poster presentations.

M. Abdul Rahiman (former Vice-Chancellor, Kannur University, Kerala), in his inaugural address, stressed on the importance of basic research in mycology that is paving the way for endless biotechnological applications in future. K. R. Sridhar (Organizing Secretary, NSRAM) and D. J. Bhat (Secretary, MSI) highlighted the origin, necessity and importance of NSRAM at the national and international level.

The president of MSI, B. P. R. Vittal, (Madras University), spoke on the 'progress and status of marine mycology in India'. He mentioned the investigations and contri-

\*A report on the National Seminar on Recent Advances in Mycology, jointly organized by Mangalore University and Mycological Society of India and held at the Department of Biosciences, Mangalore University, Mangalagangothri, during 2–3 December 2004.