Coastal water quality off Dakshina Kannada before and after tsunami

Comprising over 70% of the earth's surface, water is undoubtedly the most precious natural resource on our planet. The global and regional climatic changes influence life process even at the local level. The recent tsunami in the Indian Ocean has influenced the water quality along the Dakshina Kannada Coast, Karnataka.

Unusual changes in a few important water quality parameters in the Arabian Sea off Thannirbhavi and Chitrapur during January 2005 were observed during regular coastal water-monitoring programme. The water sampling at 4, 8, 12 and 15 m depth contour was carried out along Thannirbhavi and Chitrapur coast. Figure 1 shows the mean values of three stations at each depth contours along both the sections. The data of January 2005 were compared with those of January 2004 and 2003.

The range of water temperature during January 2005 was almost like previous years (27.20°C to 28.00°C). However, the pH of water ranged between 8.5 and 8.6 in all the stations, which is marginally higher than the previous two years. The dissolved oxygen level of the water ranged from 1.99 to 2.85 ml/l during January 2005, while during January 2003 and January 2004, it varied from 4.27 to 6.26 ml/l and 5.41 to 6.26 ml/l respectively, indicating a drastic reduction during January 2005. Further, stations located at 12 and 15 m registered very low dissolved oxygen (1.99 ml/l). An earlier study in the same area however recorded the lowest dissolved oxygen to be of 3.15 ml/l, 3.40 ml/l and 3.72 ml/l. The salinity in January 2003 and 2004 fluctuated from 31.23 to 31.87 ppt and 31.03 to 31.64 ppt respectively, whereas in January 2005 the salinity ranged between 32.25 and 32.86 ppt.

The phosphate–phosphorus content during January 2005 varied from 19.17 to 21.45 µg at/l. This is higher than the observations made during January 2003 and 2004. Such high phosphate–phosphorus content during non-monsoon months in the coastal waters of Dakshina Kannada

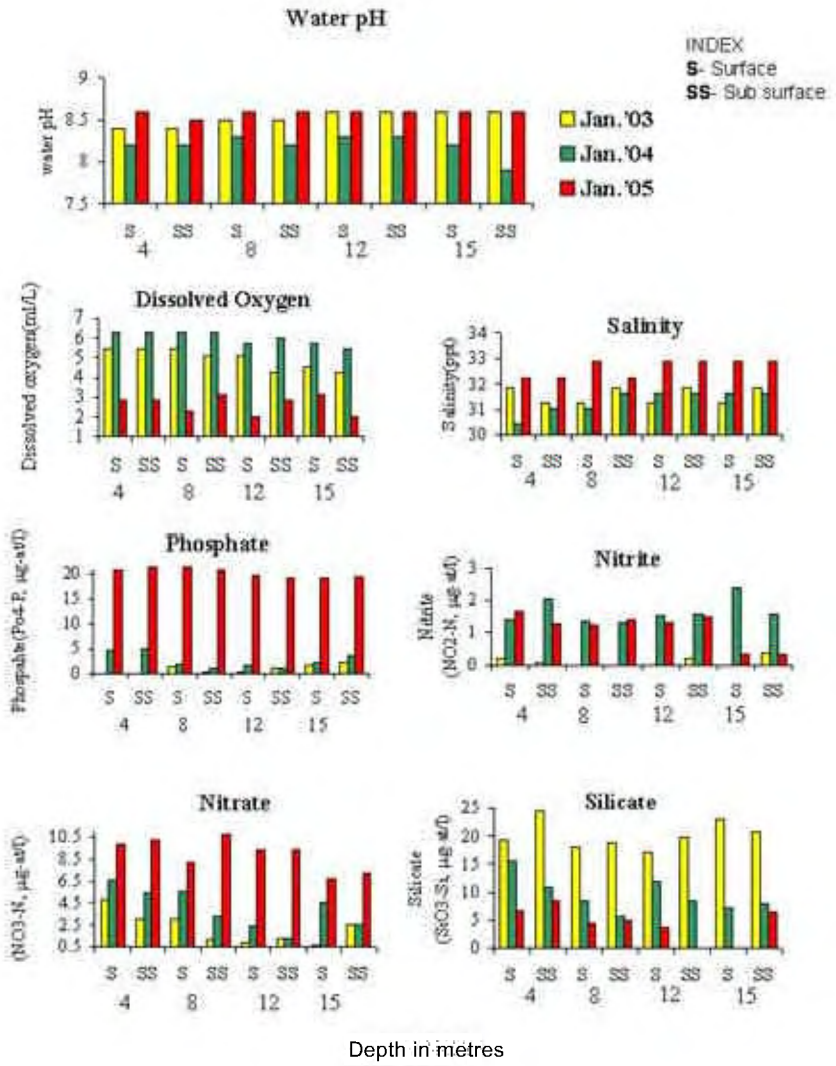

Figure 1. Variation of water quality parameters along the Dakshina Kannada coast before and after tsunami.

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 µg at/l, while during January 2003 and 2004 the values fluctuated from 0.65 to 4.75 µg at/l and 1.30 to 6.58 µg 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 µg at/l, nitrite–nitrogen from 0.76 to 1.23 µg at/l, nitrate from 3.50 to 7.28 µg at/l and silicate from 8.17 to 20.27 µg 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[1]. 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.

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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^2). 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^2), which is home to the Sangai, the Manipuri brow-antlered deer (*Cervus eldi eldi*), which is on the brink of extinction[1]. 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 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., *Sagitlaria* spp., *Saccharum latifolium*, *Erianthus puce-rus*, *Erianthus ravennae*, *Lersia hexandra*, *Carex* spp., etc. the most dominant species being *P. karka.*

Figure 1. Phoomdis choking the Loktak lake.

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[2] have shown a declining trend[3].

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.