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Impact of Pollutants on Physico-Chemical Characteristics of Dal Lake under Temperate Conditions of Kashmir

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Abstract

An investigation was carried out in four basins of Dal Lake viz. Hazratbal, Nishat, Nehru Park and Nigeen basin in Kashmir during March—December, 2008 to study the effects of pollutants on physico-chemical characteristics of Dal Lake. Water samples were collected from four basins of the lake. Nigeen basin showed the highest level of pollution than rest of the basins. The present study indicates that Dal Lake is undergoing rapid eutrophication under the increasing anthropogenic impacts in their drainage basins. The rate of pollution varies from one basin to other. It was observed that pollution problem in the basins of Dal is mainly due to addition of major plant nutrients particularly nitrogen and phosphorus, derived from human wastes, detergents and agricultural practices. The organic and inorganic pollutant load in the Dal have accelerated the macrophytic growth which in turn has reduced the water quality and biological oxygen demand (BOD) of the lake and hence have reduced the recreational and aesthetic appeal of the lake. The condition of Dal Lake has reached a critical stage from the ecological angles and if proper conservation measures are not taken in future, the lake will likely deteriorate further.
Key words : Pollutants, Water, Dal Lake, Basins.

Dal Lake is situated in the State of Jammu and Kashmir, the northern most state of India, strategically surrounded by four countries, on the east by Tibet, on the North-East by China, on the North by Afghanistan and on the west by Pakistan. Dal Lake is a Himalayan urban lake, located in the heart of Srinagar (34°18′ N latitude and 74°91′ E longitude) at an average altitude of 1,583 m. The top crust of the lake has also been observed to freeze when the mercury falls to –11 C. Early spring and summers are the wet periods when maximum rainfall occurs and average annual rainfall recorded is 655 mm. It is in this season that the snow melts in the higher catchments results in maximum discharge in Dachigam and Dara Nallah which flows into the lake. Dal Lake is unique in having hundreds of houseboats, which afford an opportunity to tourists to reside on the lake in an atmosphere of peace and tranquillity. Dal Lake comprises of five basins viz. Hazratbal, Bod-Dal, Gagribal, Nageen and Brari-Nambal. A perennial inflow channel known as Telbal Nallah enters the lake from the north and supplies 80 per cent of the water from a high altitude lake called Marsar lake (1). Within the lake basin itself there are number of springs (2) which act as permanent water source to the lake. During the past few years grave concern is being voiced by people from different walks of life over the deteriorating conditions of Dal lake. Dal Lake has fallen victim to human greed as a result of which the entire ecosystem is rapidly changing (3). The water quality of Dal Lake has deteriorated considerably in the last three decades due to hyper-eutrophication, illegal encroachments, organic matter dumping, sewage and other pollutants. Keeping these in view, the ecological significance of water bodies in Kashmir lake Dal Lake, the present investigation was undertaken to determine the effect of pollutants on physico-chemical characteristics of Dal Lake.

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Methods

The present investigation were carried out during March to December 2008 in four basins of Dal Lake of Kashmir viz.Hazaratbal, Nishat, Nehru Park

Table 1. Water quality changes in Hazratbal basin of Dal Lake. *Source : LAWDA (Lakes and Waterways Development Authority), # observed.

	Parameters	2007*	2008#
1.	Air temperature (C)	18.2	18.8
2.	Water temperature (C)	16.4	15.4
3.	pH	7.8	7.5
4.	Specific conductivity (μ at 25 C)	394	422
5.	Dissolved oxygen (mg/l)	7.0	6.5
6.	Total alkalinity (mg/l)	102	105.2
7.	Silicate (mg/l)	4.0	3.6
8.	Nitrate nitrogen (mg/l)	5.07	665
9.	Total phosphorus (mg/l)	504	583
10.	Ammonical nitrogen (mg/l)	366	345

and Nigeen basin to evaluate the parameters of ecological concern.

The physico-chemical parameters were analyzed by laid standard procedures. Water samples collected from four basin of Dal Lake viz., Hazaratbal, Nishat, Nehru Park and Nigeen were analyzed for water temperature, conductivity, total phosphorus, nitrates, ammonia, silicate, dissolved oxygen, pH and total alkalinity. All the physico-chemical analyses of water samples were done in the J & K lakes and water ways development authority, Srinagar.

Results and Discussion

Water Quality Changes in Hazaratbal Basin of Dal Lake

Table 1 indicates that air temperature, specific conductivity, total alkalinity, nitrate nitrogen and total phosphorus increased significantly. However water temperature, pH, dissolved oxygen, silicate and ammonical nitrogen showed a progressive decline. The significant increase in air temperature, specific conductivity, total alkalinity, nitrate nitrogen and ammonical nitrogen could be attributed to continued to drought conditions while the decrease in pH, water temperature, dissolved oxygen, silicate and ammonical nitrogen may be due to efficient utilization of these elements by this aquatic weeds (4).

Table 2. Water quality changes in Nishat basin of Dal Lake. *Source : LAWDA (Lakes and Waterways Development Authority), # observed.

	Parameters	2007*	2008#
1.	Air temperature (C)	18.5	23.8
2.	Water temperature (C)	16.6	16.1
3.	pH	8.1	7.8
4.	Specific conductivity (μ at 25 C)	277	296
5.	Dissolved oxygen (mg/l)	7.3	7.8
6.	Total alkalinity (mg/l)	56	45
7.	Silicate (mg/l)	3.1	3.5
8.	Nitrate nitrogen (mg/l)	456	493
9.	Total phosphorus (mg/l)	507	6.8
10.	Ammonical nitrogen (mg/l)	263	223

Water Quality Changes in Nishat Basin of Dal Lake

Table 2 shows that air temperature, specific conductivity, dissolved oxygen, silicates, nitrate nitrogen and total phosphorus have increased during the whole investigation while as water temperature, pH, total alkalinity and ammonical nitrogen decreased. The progressive increase in water quality parameters could be attributed to hyper-entrophication and continued drought conditions while a decrease in water temperature, pH, total alkalinity and amonicical nitrogen could be due to heavy growth of aquatic weeds which efficiently utilize the ammonical nitrogen in the lake (5).

Table 3. Water quality changes in Nehru park basin of Dal Lake. *Source : LAWDA (Lakes and Waterways Development Authority), #observed.

	Parameters	2007*	2008#
1.	Air temperature (C)	19.4	22.8
2.	Water temperature (C)	17.4	18.1
3.	pH	7.9	7.2
4.	Specific conductivity (μ at 25 C)	333	386
5.	Dissolved oxygen (mg/l)	6.4	6.1
6.	Total alkalinity (mg/l)	87	84.8
7.	Silicate (mg/l)	3.8	4.0
8.	Nitrate nitrogen (mg/l)	752	770
9.	Total phosphorus (mg/l)	535	521
10.	Ammonical nitrogen (mg/l)	662	698

Water Quality Changes in Nehru Park Basin of Dal Lake

Table 3 shows that air temperature, water temperature, specific conductivity, silicate, nitrate nitrogen, and ammonical nitrogen have increased while as pH, dissolved oxygen, total alkalinity and total phosphorus showed a significant decrease. The faster rate of increase in air temperature, silicate, nitrate nitro-

Table 4. Water quality changes in Nigeen basin of Dal Lake. *Source : LAWDA (Lakes and Waterways Development Authority), # observed.

	Parameter	2007*	2008#
1.	Air temperature (C)	17.2	16.8
2.	Water temperature (C)	15.3	15.7
3.	pH	8.0	7.8
4.	Specific conductivity (μ at 25 C)	486	537
5.	Dissolved oxygen (mg/l)	6.5	6.2
6.	Total alkalinity (mg/l)	125	126.2
7.	Silicate (mg/l)	4.2	4.5
8.	Nitrate nitrogen (mg/l)	442	582
9.	Total phosphorus (mg/l)	570	532
10.	Ammonical nitrogen (mg/l)	461	348

gen and ammonical nitrogen could be ascribed to eutrophication and efficient utilization and trapping of sunlight by the water body (6) where as the decrease in pH, dissolved oxygen, total alkalinity and total phosphorus may be due to efficient utilization of phosphorus by macrophytic vegetation in the Lake (7).

Water Quality Changes in Nigeen Basin of Dal Lake

Table 4 indicates that water quality parameters like water temperature, specific conductivity, total alkalinity, silicate and nitrate nitrogen have increased while as air temperature, pH, dissolved oxygen, silicate, total phosphorus and ammonical nitrogen have progressively decreased. The increase in these water quality parameters could be attributed to continued drought conditions and eutrophication in the Lake (8), whereas the decrease in air temperature, pH, dissolved oxygen silicate, total phosphorus and nitrates may be due to thermal stratification of the Lake and efficient utilization of these elements by macrophytic vegetation in the Lake (9).

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