

The status of renuka lake and parshuramtal

[Science](#), [Biology](#)



Water is a necessity for all living beings, without it; there would be no life. Most of the biological phenomena take place in water medium. Globally, freshwater has become the fastest depleting natural resource now days. Phytoplankton are vital and important organisms which act as producer to the primary food supply in any aquatic ecosystem. They are the initial biological components from which then energy is transferred to higher organisms through food chain (Tiwari and Chauhan, 2006; Saifullah et al., 2014). The presence of phytoplankton in any water body can lead to productive and sustainability of that water body. The assemblage in the form of composition and distribution is dependent on the physical, chemical and biological properties of water (Patil et al., 2015). The physico-chemical parameters are the major factors that control the dynamics and structure of the phytoplankton of aquatic ecosystem (Hulyal and Kaliwal, 2009). Variations in these parameters have an important role in the distribution, periodicity and quantitative and qualitative composition of freshwater biota. Kaul et al. (1980) stated that dissolved oxygen has been used as a most reliable parameter of lake eutrophication. Adak et al. (2002) reported that different physico-chemical parameters of water are very important for effective maintenance of water quality through appropriate control. World over, the lakes have been subjected to investigations on varied aspects by Das et al., 1969; Das and Akthar, 1971; Zutshi and Vass, 1973; Kant and Anand, 1978; Sharma and Pant, 1979; Schindler et al., 1981; Willen et al., 1990; George et al., 1990; Schindler et al., 1996; Battarbee, 2000; Gerardo, 2001; Tolotti, 2001; Awasti and Tiwari, 2004; Rawat and Sharma 2005; Akoma and Imoobe, 2009; Hulyal and Kaliwal, 2009; Rawat et al, 2012; Singh

and Banyal, 2013; Bheemappa et al., 2015; Dixit, et al, 2015; Khade, 2015 and Qureshimatva et al. 2015; Singh et al, 2016.

Only few studies were carried out in lakes of Himachal Pradesh by Singh and Sharma (1985) on phytoplankton and water quality of Dashair Lake. Cultural impact on fish fauna of Rewalsa Lake (Singh, 1986). Study of the major ion chemistry of Renuka Lake was done by Das and Kaur (2001) and the physicochemical parameters of Pongdam reservoir, was studied by Negi et al. (2006). The present study was conducted to know the status of Renuka lake and Parshuram Tal, as hundreds of tourists/people approached these lakes through out the year.

MATERIALS AND METHODS

Study Area: The Renuka wetland is surrounded by lush green forest and has two water body, one is the main Renuka Lake (20 ha) and the other one, comparatively smaller, is known as Parshuram Tal. Parshuram Tal receives water from the main Renuka Lake through a small graveled channel. Renuka Lake is about 1050m in length 204m in width from its broadest point and depth varies up to 13m. Length of Parshuram Tal is 173m and width is 160m (approx). Sampling for ascertaining the diversity and density of Phytoplankton and physicochemical characteristics along with the of Renuka Lake was conducted at six sampling sites i. e., S1, S2, S3, S4, S5 and S6, while Parshuram Tal was conducted at two sampling sites i. e., S7 and S8 during the present study.

Phytoplankton and Physicochemical analysis: Monthly sampling was carried out to collect data on phytoplankton community and selected

physicochemical parameters and of the lakes during December 2013 to May 2014. Phytoplankton samples were collected by filtering 100 litre of water through phytoplankton net and preserved in 4% formalin. Further analysis was done in laboratory. Phytoplankton were identified up to the lowest recognizable taxonomic unit mostly genus following keys by Needham and Needham (1962), Ward and Whipple (1959), Sarode and Kamat (1984), Phytoplankton were enumerated using Sedgwick-Rafter Cell Counter and number of plankton per ml of water was calculated according to Welch (1952). Physicochemical parameters were studied following standard methods outlined in Welch (1952), Trivedy and Goel (1986) and APHA (1995). Phytoplankton density was subjected to further analysis by applying the Shannon-Wiener species diversity index (Shannon and Wiener, 1963), Margalef (richness) index Evenness index and Palmer index.

RESULT AND DISCUSSION

The average temperature of Renuka Lake ranged between 13.83 ± 4.45 °C and 19.83 ± 1.33 °C and in Parshuram Tal it ranged between 14.00 ± 1.41 °C and 19.50 ± 0.71 °C, while, average water temperature of Renuka Lake ranged between 11.00 ± 2.37 °C and 17.17 ± 2.32 °C, in Parshuram Tal it was maximum 12.50 ± 2.12 °C and 19.50 ± 0.71 °C. Temperature is a very important abiotic factor. In any aquatic ecosystem, it not only governs the metabolic and physiological behaviour of the inhabiting organisms but also has a profound influence on other physico-chemical parameters thereby affecting various physical and chemical processes occurring within the lake ecosystem (Welch, 1952; Clarke, 1959). The fall in air temperature during winter months may be attributed to the shorter day length/photoperiod and

oblique incident rays. The increase in air temperature during March to May may be attributed to increased day/photoperiod, vertical incident rays and heating up of atmosphere as a result of absorption of heat by suspended particles (Welch, 1952; Munawar, 1970; Sharma, 1999).

The average dissolved oxygen in Renuka Lake water ranged between 7. 12±0. 66 mg l-l and 9. 80±2. 60 mg l-l. In Parshuram Tal it was recorded between 6. 55±0. 49 mg l-l and 12. 00±2. 83 mg l-l. Higher values in DO content (February'2014) could be attributed to the optimal day length and light intensity for photosynthesis which coincides with the studies of (Qadri and Yousuf, 1980), Decline in DO values during early spring in both lakes could may be attributed to increased day length and light intensity which after having acquired the optimal factor for photosynthesis and tends to decrease DO production.

The average bicarbonate alkalinity of Renuka Lake ranged from 52. 0±19. 43 mg l-l to 70. 00±25. 30 mg l-l. In Parshuram Tal it varied from 35. 00±7. 07 mg l-l to 87. 50±3. 54 mg l-l. The average carbonate alkalinity was observed at site S3 in Renuka Lake 20. 00±0. 0 mg l-l to 40. 00±0. 00 mg l-l.

Carbonates alkalinity was reported at Site S3. It was may be due to the removal of carbon dioxide by photosynthesis of plants (microbes, algae, floating phytoplankton, macrophytes) and less commonly by changes in temperature, evaporation or mixing of water masses, resulting in the precipitation of low-Mg calcite (Flugel, 2010). Bicarbonate alkalinity in a water body is a measure of its buffering capacity. It is added to water system

as a result of surface runoff during rains either through soil or rocks containing bicarbonate minerals (Ram et al., 2008).

The average pH of Renuka Lake varied from 7.57 ± 0.41 to 7.70 ± 0.32 , while in Parshuram Tal pH ranges in between 7.80 ± 0.00 to 8.00 ± 0.00 (Table 1). The average transparency of Renuka Lake and Parshuram Tal fluctuated in between 37.00 ± 6.32 cm to 38.50 ± 0.00 and 28.50 ± 0.71 cm to maximum 31.00 ± 2.83 , respectively (Table 1). Decline of water transparency in winter months could also be assigned to mixing of lower layers of lake water with upper layers as a result of lake overturning during these months. This is in agreement with the observation of Sehgal (1980) but Zutshi (1985), Sharma (1999) and Zuber (2007) who recorded an increase in transparency during winters. A total of 28 genera of phytoplankton were identified from the Renuka Lake, these belonged to 20 families of 10 orders and 3 classes whereas from Parshuram Tal 24 genera belonged to 17 families of 10 orders and 3 classes during the study period. The highest number of phytoplanktonic genera in Renuka Lake and Parshuram Tal belonged to class chlorophyceae (18 and 16) followed by bacillariophyceae (9 and 7), and myxophyceae (1 and 1), respectively. In Pong Wetland in Himachal Pradesh 24 species of phytoplankton were reported by Negi et al. (2004). Das et al., (1969) studies Dal Lake of Kashmir and identified 35 species of phytoplankton. In Garhwal, Rawat and Sharma (2005) reported 36 species from Deoria Tal, whereas, Rawat et al. (2012) reported 22 genera of phytoplankton belonging to 16 families of 6 orders and 4 classes from Dodi Tal.

The total density of phytoplankton of Renuka Lake ranged from 108.0 unit l⁻¹ to 684.0 unit l⁻¹. The total density of phytoplankton of Parshuram Tal ranged from 40.0 unit l⁻¹ to 382.0 unit l⁻¹. Closterium, Gonatozygon, Stephnodiscus were dominant Chlorella, Volvox, Eunotia was sub dominant. Pleodorina, Richterilla, Mougetia, Ulothrix, Amphora, Synedra were frequent and Penium, Scendesmus were rare in Renuka Lake. In Parshuram Tal Gonatozygon, Volvox was dominant. Oscillatoria was sub dominant. Navicula, epithemia. Scendesmus were frequent and Pleodorina, Rhizoclonium, Penium were rare phytoplankton

The green algae (Chlorophyceae) had largest contribution followed by diatoms (Bacillariophyceae) and Myxophyceae. Spirogyra (chlorophyceae) was dominant in winter. Similarly, Negi et al. (2004) reported it to be dominant in Pong Wetland in Himachal Pradesh. Pediastrum species of chlorophyceae was frequently observed during the study period, it has been reported that Pediastrum species are more common in eutrophic water than in oligotrophic water (Hutchinson, 1967). Rawson (1956) related dominancy of chlorophyceae with cleaning of lake water. Zutshi et al. (1980) correlated lake fertility and algal group. In the lake of low fertility the phytoplankton was dominated by diatoms and chlorophyceae but in eutrophic lakes, cyanophyceae predominated. Both Renuka Lake and Parshuram Tal was dominated by chlorophyceae and diatoms during the study period thus both lakes fall under the category of oligotrophic lake. In Renuka Lake among the phytoplankton, chlorophyceae was the dominant class (53.70%), followed by bacillariophyceae (43.70%) and myxophyceae (2.59%). While, in Parshuram Tal chlorophyceae constituted 57.54% of the phytoplanktonic community,

followed by bacillariophyceae (29.10%), and myxophyceae (13.36%). Rawat and Sharma (2005) and Rawat et al. (2012) also reported highest percentage contribution by chlorophyceae followed by bacillariophyceae in the Garhwal Himalayan lakes.

The Shannon-wiener diversity index calculated varied between 0.774 to 3.049 in Renuka Lake, Whereas, in Parshuram Tal it varied between 0.485 and 2.340. The phytoplankton species richness of Renuka Lake was recorded between 2.073 and 6.537, Whereas, in Parshuram Tal, it ranged between 2.573 and 7.770. The evenness index of phytoplankton of Renuka Lake varied between 0.253 and 0.962, while, in Parshuram Tal it varied between 0.153 and 0.738 during the study period.

Whitton (1975) mentioned the same that values of less than 1 are interpreted as heavily polluted, 1-3 as moderately polluted and more than 3 as clean water. Shannon-wiener diversity index () almost near to 3 for phytoplankton suggests that water is good for growth of phytoplankton in water body (Ali et al., 2005). During the study period it was observed that in Renuka Lake and Parshuram Tal Shannon-Wiener index calculated indicated that the water fall in the range of polluted to clean water due to highly influx of tourist during summer season and low in winter.

Relative species abundance in a community is another factor that affects diversity (Whittaker, 1965; Hurlbert, 1971). It is measured with a standardized index of species abundance (evenness or equatability) that is typically on a scale ranging from near 0, which indicates low evenness or high single-species dominance, to 1, which indicates equal abundance of all

species or maximum evenness (Routledge, 1980; Alatalo, 1981). Hosamani (2010) concluded that the evenness value takes between 0 and 1, with 1 being complete evenness. The index applied to the present study indicated that individuals of the phytoplankton community in Renuka Lake and Parshuram Tal are not evenly distributed as the values ranged from 0.253 to 0.962 and 0.153 to 0.738, respectively.

For the calculation of Palmer index, table is taken in use. This table no. 5 provides 20 algal genera most tolerant to organic pollution and a number is assigned to each of them depending on their relative tolerance. The algae present in a water sample are identified and the genera present from this list are noticed (other genera are ignored). An algae is called present when 50 or more individuals of it are present in one ml of water. The numbers scored by each genera are totalled to get the value of algal genus index. A score of 20 or more for a sample is indication of organic pollution, while a score of 15 to 19 is taken as probable evidence of high organic pollution. Lower figure indicates that the organic pollution is not high or the sampling has not been representative.

In the present study period the value of palmer index of Renuka Lake ranged in between 17 to 18 score, whereas, in Parshuram Tal value of palmer index ranged in between 7 to 11. Therefore, from the above values it is indicated that Renuka Lake is taken as probable evidence of high organic pollution due to the reason that in Renuka Lake, there is human interference in the form of boating and regular bathing, while, some sites of Renuka Lake evidence with inflow of the soil erosion and dry leaves of the surrounding trees. In

Parshuram Tal there is no organic pollution as no human interference is observed there during the present study period.