LAKE

Forel (1892) considered all bodies of standing water irrespective of their size as lakes. Welch (1952) also regarded all large bodies of standing water as lakes. Forel (1901) for the first time classified the lakes of the world, into polar, temperate and tropical lakes on their thermal characteristics. However, Welch (1935) classified the lakes on the basis of physical, chemical and biological features as follows:

1. Oligotrophic lakes:

   Water blue to green and very transparent; little or no organic materials on the bottom in deeper water; aquatic plants rare.
2. **Eutrophic lakes:**

Water green to yellow and brownish green, and not very transparent; large quantity of organic materials on the bottom and suspended in the water; aquatic plants abundant.

3. **Dystrophic:**

Water yellow to brown and with low transparency; large quantity of organic mud on the bottom; aquatic plants rare.

Yoshimura (1936) modified Forel's classification, and classified lakes as tropical, subtropical, temperate, sub-polar and polar, on the basis of temperature, thermal gradient and circulation period. Rawson (1939) classified lakes on the basis of conductivity and, according to him, oligotrophic lakes have conductivity less than 100 μ mhos, intermediate lakes have 125 μ mhos and eutrophic lakes have 200 μ mhos. Philippine (1960) on the basis of total alkalinity, confined water have divided into three categories; the first category has low alkalinity of 4 to 50 ppm, and the second category has medium alkalinity of 50-100 ppm while the third category has high alkalinity of 100 to 200 ppm or above.

**Sagar** is situated at latitude 23°50' N and longitude 78°45' E, and stands over a hilly terrain at an approximate height of 517 m above mean sea level.

The Sagar lake is mainly rainfed, and situated in the heart of Sagar city. The lake is surrounded on three sides -
eastern, western and northern by a number of ghats and human habitation, the fourth side of the lake stretches across lowly marshy field up to the base of the overlooking hills. Particulars of the lake given in a report of the Municipal Committee of Sagar (1911) are as follows:

1. Full water spread area - 442 acres.
2. Water spread area at ordinary summer level - 185 acres.
3. Extreme depth of weir level - 9 ft.
4. Average depth at weir level - 17 ft.
5. Extreme depth at ordinary summer level - 10½ ft.
6. Average depth at ordinary summer level - 2½ ft.
7. Full capacity - 173 m.c.ft.

However, the present area of the lake is about 200 acres and the catchment area is about 5.51 acres. The north-east side of the lake near the city Bus stand receives pollution of domestic sewage. Apart from this, the lake also gets some pollutants due to bathing, cloth washing and wallowing of cattle. The main drainage is northward. There is an outlet (weir) on the south-west side of the lake, behind the famous Ganga Mandir (Plate 1, Fig. 1).

According to West and Chaubey (1964), it is believed that the lake was formed at the close of the cretaceous period, and the rocks at the bottom belong to the pre-cambrian period. There are a number of stories regarding the origin of Sagar lake. According to Thakur (1897) Sagar lake was constructed in the 16th century.
Mishra (1969) expressed the view that Sagar lake has been formed by damming of the north-west ward drainage and the construction of the bund on the western side, due to disastrous famines at the end of the 19th century.

The climatic features of Sagar lake have been reported by Misra and Joshi (1952), Pandeya (1953, 54), Mishra (1961), Krishnan (1967), Bhatnagar (1968) and Joseph (1977). The climate of the Sagar is generally pleasant and salubrious. Winter lasts from November to February, summer from March to June, and the rainy season from July to October. The Meteorological data have been obtained from the Physio Department, Dr. Harisingh Gour Vishwavidyalaya, Sagar (Table 1). December and January are the coldest months of the winter and have an average mean monthly temperature of 17.6°C. The average mean monthly temperature reaches the highest point of 30.6°C, in the month of May and the rainfall reaches the highest point of 567 mm in the month of August (Plate 2, Fig. 2). During the rainy season, generally heavy clouds or overcast skies are observed. In the other seasons, the sky is generally clear or lightly clouded. The average rainfall at Sagar is about 1,237 mm, from data of 61 years; the total rainfall of the years 1977 and 1978 was 1,705 mm and 1,945 mm respectively (Table 1).

Macrovegetations were observed in abundance all along the littoral zones of the Sagar lake (Plate 1, Fig. 1) and are probably responsible for silting and raising the bed
Table 1
Meteorological data (August 1977 - July 1978)

<table>
<thead>
<tr>
<th>Months</th>
<th>Rainfall (mm)</th>
<th>Temperature (°C)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean minimum</td>
<td>Mean maximum</td>
<td>Average</td>
<td></td>
</tr>
<tr>
<td>August</td>
<td>567</td>
<td>22.4</td>
<td>26.2</td>
<td>25.3</td>
<td></td>
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<tr>
<td>September</td>
<td>210</td>
<td>22.1</td>
<td>30.4</td>
<td>26.2</td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>16</td>
<td>21.2</td>
<td>35.6</td>
<td>28.4</td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>68</td>
<td>15.9</td>
<td>32.9</td>
<td>24.4</td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>-</td>
<td>13.5</td>
<td>22.2</td>
<td>17.8</td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>-</td>
<td>9.2</td>
<td>26.5</td>
<td>17.8</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>130</td>
<td>13.5</td>
<td>25.8</td>
<td>19.6</td>
<td></td>
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<tr>
<td>March</td>
<td>75</td>
<td>15.6</td>
<td>32.2</td>
<td>23.9</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>13</td>
<td>17.6</td>
<td>38.6</td>
<td>28.1</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>-</td>
<td>18.0</td>
<td>43.3</td>
<td>30.6</td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>219</td>
<td>22.3</td>
<td>38.6</td>
<td>30.4</td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>402</td>
<td>22.3</td>
<td>31.2</td>
<td>26.7</td>
<td></td>
</tr>
</tbody>
</table>

Total rainfall: 1977 - 1705 mm
1978 - 1945 mm
level of the lake. The following rooted plants are very common and are found in abundance: Najas sp., Hydrilla verticillata, Potamogeton 3 species, Ceratophyllum sp. and Vallisneria spiralis. Apart from the rooted plants the four common grasses, Parsiolum proliferum, Oryza sativa, Paspalidium germinatum and Hydrorhiza aristata were also recorded. Eleven types of sedges were also noted. Two species of Nymphaea, Trapa bispinosa and two species of Nymphoides were found in the Sagar lake.

Swarup (1953), for the first time, gave a preliminary report on the fishes of Sagar lake and enumerated the following 21 species:

1. Family Notopteridae:
   Notopterus notopterus

2. Family Cyprinidae:
   Barbus tiota, Barbus stigma, Barbus sarana,
   Labeo boscat, Labeo nukta.

3. Family Cobitidae:
   Lepidocephalichthys balsara

4. Family Siluridae:
   Heteropneustes fossilis, Wallago attu,
   Eutropiichthys vaoh, Callichrous bimaoulatus,
   Pseudeutroplus garua, Mystus senegal,
   Mystus vittatus.

5. Family Belonidae:
   Belone can cola
6. **Family Ophiocephalidae**:  
   *Ophiocephalus striatus*, *Ophiocephalus punctatus*,  
   *Ophiocephalus gachua*.

7. **Family Nandidae** : 
   *Nandus nandus*

8. **Family Mastacembelidae**: 
   *Mastacembelus panchul*, *Mastacembelus armatus*.

From the above account it may be seen that seven species belong to the family Siluridae, five to Cyprinidae, three to Ophiocephalidae, two to Mastacembelidae and one to each of the families of Cobitidae, Notopteridae, Belonidae, and Nandidae. Soni (1968-69) carried out a detailed survey of the lake, and mentioned the following species of fishes in addition to those identified by Swarup.

- *Rasbora daniconius*
- *Barilius bendelisis*
- *Danio aquippinnatus*
- *Rohteo cotic*
- *Myatus bleiieri*
- *Ambassis ranga* and  
  *Badis buchanani*.

Soni and Srivastava (1979) have reported 21 predatory fishes in the Sagar lake. Thus it is evident from the above account that the number of predatory fishes are more than the other fishes.
However, neither Swarup (1953) nor Soni (1968-69) has reported the presence of cultivable fishes in the Sagar lake. The cultivable fishes were introduced by the Fisheries Department, Government of Madhya Pradesh, in 1965-66 for cultivation in the Sagar lake. The fries of the fishes were brought from Calcutta and reared in the nursery tanks at Ratona, 5 miles away from the city. Fingerlings were transported for cultivation in Sagar lake.