The analysis of collected data on the relevant physical, chemical and biological parameters (detailed in Chapter 2) for different months and seasons - spanned over thirteen months- are presented in this chapter. An Attempt has been made to present the results in a form to bring out the salient features coupled with the measured parameters. Measurements of all parameters were done on triplicate water samples collected from four randomly selected sampling locations on pre-assigned contour lines drawn in reference to the center of the lake. As referred in Chapter 2, water samples at each selected location were collected from the surface, euphotic depth and lake bed. The presentation of the results is done in a graphical form where the changes are plotted to delineate, (1) the annual variation of the measured parameters, where each point represent the monthly average for the lake and (2) the variation within the lake (surface, middle and bottom surface) for a given month. For convenience and brevity, the results are presented in the following order: (i) physical and microclimatic variables, (ii) chemical variables, (iii) biological variables and (iv) spectral finger printing analysis of all samples. For convenience, all the figures in this chapter are given at the end of the text. To show different layers in the lake, green, blue and red colours are used for upper, middle and lower layers respectively, in all the graphs showing layer wise variations.

Physical and Microclimatic Variables

Temperature

In the present study, the air temperature generally varied between 15.8 °C to 36.2 °C at the lake site. Air temperature was measured two feet above the water surface while collecting the water samples. The monthly trend of air temperature over the period of 13 months is shown in Table 3.1. Temperature of water samples was measured immediately
Table 3.1: Monthly Variation of Air Temperature (°C)

<table>
<thead>
<tr>
<th>Months</th>
<th>Air Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 1999</td>
<td>15.8</td>
</tr>
<tr>
<td>February</td>
<td>19.3</td>
</tr>
<tr>
<td>March</td>
<td>21.6</td>
</tr>
<tr>
<td>April</td>
<td>28.2</td>
</tr>
<tr>
<td>May</td>
<td>34.6</td>
</tr>
<tr>
<td>June</td>
<td>36.2</td>
</tr>
<tr>
<td>July</td>
<td>30.1</td>
</tr>
<tr>
<td>August</td>
<td>32.9</td>
</tr>
<tr>
<td>September</td>
<td>29.3</td>
</tr>
<tr>
<td>October</td>
<td>26.2</td>
</tr>
<tr>
<td>November</td>
<td>20.6</td>
</tr>
<tr>
<td>December</td>
<td>18.5</td>
</tr>
<tr>
<td>January 2000</td>
<td>17.4</td>
</tr>
</tbody>
</table>

Table 3.2: Average Water Temperature of the Samples

<table>
<thead>
<tr>
<th>Months</th>
<th>Avg. Temp. (°C)</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 1999</td>
<td>13.4</td>
<td>0.42</td>
</tr>
<tr>
<td>February</td>
<td>16.4</td>
<td>0.59</td>
</tr>
<tr>
<td>March</td>
<td>20.6</td>
<td>0.15</td>
</tr>
<tr>
<td>April</td>
<td>23.7</td>
<td>0.96</td>
</tr>
<tr>
<td>May</td>
<td>28.6</td>
<td>0.75</td>
</tr>
<tr>
<td>June</td>
<td>30.9</td>
<td>1.65</td>
</tr>
<tr>
<td>July</td>
<td>27.4</td>
<td>0.70</td>
</tr>
<tr>
<td>August</td>
<td>30.5</td>
<td>0.42</td>
</tr>
<tr>
<td>September</td>
<td>26.2</td>
<td>0.45</td>
</tr>
<tr>
<td>October</td>
<td>25.0</td>
<td>0.40</td>
</tr>
<tr>
<td>November</td>
<td>19.4</td>
<td>0.70</td>
</tr>
<tr>
<td>December</td>
<td>16.9</td>
<td>0.70</td>
</tr>
<tr>
<td>January 2000</td>
<td>16.2</td>
<td>0.76</td>
</tr>
</tbody>
</table>
after its collection from different depths. The values (that represent average values) with their respective standard deviations are shown in Table 3.2. Water temperature at different contours of the lake varied between 12.9 °C to 32.5 °C during the sampling period. The maximum average water temperature was recorded as 30.9 °C in the month of June and the minimum average temperature recorded was 13.4 °C in the month of January, which corresponded well with atmospheric temperature.

**Euphotic Depth and Total Depth of the Lake**

Euphotic depth was one of the important criteria used while collecting water samples. Table 3.3 shows the measured depth at respective contours. C0 represents the center of the lake. The trend indicates shallow euphotic depth during the months of April-September and this alters during the rest of the year.

**Table 3.3: Euphotic Depth in Centimeter**

<table>
<thead>
<tr>
<th>Contours</th>
<th>Jan '99</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan 2k</th>
</tr>
</thead>
<tbody>
<tr>
<td>C0</td>
<td>250</td>
<td>275</td>
<td>240</td>
<td>150</td>
<td>140</td>
<td>130</td>
<td>120</td>
<td>140</td>
<td>155</td>
<td>180</td>
<td>130</td>
<td>255</td>
<td>280</td>
</tr>
<tr>
<td>C1</td>
<td>200</td>
<td>250</td>
<td>180</td>
<td>160</td>
<td>155</td>
<td>140</td>
<td>110</td>
<td>160</td>
<td>165</td>
<td>205</td>
<td>110</td>
<td>240</td>
<td>275</td>
</tr>
<tr>
<td>C2</td>
<td>255</td>
<td>275</td>
<td>150</td>
<td>130</td>
<td>145</td>
<td>110</td>
<td>95</td>
<td>150</td>
<td>145</td>
<td>180</td>
<td>145</td>
<td>190</td>
<td>260</td>
</tr>
<tr>
<td>C3</td>
<td>175</td>
<td>200</td>
<td>165</td>
<td>150</td>
<td>130</td>
<td>90</td>
<td>110</td>
<td>110</td>
<td>150</td>
<td>160</td>
<td>120</td>
<td>205</td>
<td>190</td>
</tr>
<tr>
<td>C4</td>
<td>170</td>
<td>200</td>
<td>125</td>
<td>260</td>
<td>140</td>
<td>95</td>
<td>105</td>
<td>113</td>
<td>160</td>
<td>260</td>
<td>100</td>
<td>185</td>
<td>130</td>
</tr>
</tbody>
</table>

Total depth, taken from the surface of the water to the base of the lake at each respective contour in different months, was also measured and these values are given in

51
Table 3.4. Maximum depth at a given location undergoes a change every month. This will depend on the rainfall pattern and runoff factors around the lake. In addition, random selection of the sampling location on a contour can have different depths. Variation in measured depth due to rainfall, runoff and evaporation can be seen best for C0, as this location was fixed throughout the period of this study.

Table 3.4: Maximum Lake Bed Depth Represented in Centimeter

<table>
<thead>
<tr>
<th>Sites</th>
<th>Jan'99</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan2K</th>
</tr>
</thead>
<tbody>
<tr>
<td>C0</td>
<td>495</td>
<td>480</td>
<td>510</td>
<td>455</td>
<td>430</td>
<td>465</td>
<td>545</td>
<td>575</td>
<td>535</td>
<td>505</td>
<td>510</td>
<td>490</td>
<td>460</td>
</tr>
<tr>
<td>C1</td>
<td>425</td>
<td>465</td>
<td>350</td>
<td>480</td>
<td>450</td>
<td>405</td>
<td>560</td>
<td>520</td>
<td>490</td>
<td>475</td>
<td>435</td>
<td>505</td>
<td>440</td>
</tr>
<tr>
<td>C2</td>
<td>330</td>
<td>380</td>
<td>495</td>
<td>390</td>
<td>405</td>
<td>520</td>
<td>550</td>
<td>425</td>
<td>515</td>
<td>390</td>
<td>490</td>
<td>380</td>
<td>390</td>
</tr>
<tr>
<td>C3</td>
<td>390</td>
<td>250</td>
<td>375</td>
<td>380</td>
<td>315</td>
<td>485</td>
<td>660</td>
<td>225</td>
<td>380</td>
<td>640</td>
<td>260</td>
<td>430</td>
<td>235</td>
</tr>
<tr>
<td>C4</td>
<td>230</td>
<td>200</td>
<td>175</td>
<td>275</td>
<td>210</td>
<td>230</td>
<td>350</td>
<td>190</td>
<td>200</td>
<td>260</td>
<td>360</td>
<td>410</td>
<td>130</td>
</tr>
</tbody>
</table>

The relevant meteorological parameters (cloud cover, humidity, air temperature, wind speed, rain fall, total solar flux and sunshine hours) needed to interpret the results, were also recorded. Their role is discussed in detail while analyzing the physical, chemical and biological aspects of lake Badhkal in this chapter.

pH

The variation in the pH was monitored at five selected contours, for different months. Water samples collected from the lake were found to be alkaline throughout the year. The mean pH values during the study period ranged from 8.03 to 8.58, depicting a
narrow difference of only 0.55 units between the maximum and minimum values. The pH at the center of the lake (C0) showed the minimum value (8.07) in the month of April and maximum value (8.5) occurred in the month of August 1999. The average pH, observed in the month of January 1999, was 8.45 and after that, a consistent decline was observed till the month of April. The pH value observed in this month was 8.07. In the month of May, pH increased slightly to 8.15 and subsequently decreased to 8.09 in the month of June. Further, an increase in pH was observed in the months of July (8.4) and August (8.5). In the months of September and October, a decrease was observed in pH values. Then, a steady increase in pH was observed till January 2000. The monthly changes, in measured average pH values, are shown in Figure 3.1 (a-e). These figures show the plotted trends of annual average pH for water samples collected from the different contours of the lake.

pH variation was also observed for water samples collected from different contours. For samples collected from contour 1, the lake water showed maximum pH (8.48) in the month of August and minimum (8.10) in the month of June (pH 8.10). Similar trends were observed in samples collected from other contours, barring minor deviations. Water samples taken from contour 2 were also found to be alkaline throughout the year. In the month of June, pH was minimum (8.03), while maximum pH (8.58) was observed in the month of January 1999. At contour 3, minimum pH (8.14) was observed in the month of April. The maximum pH (8.53) was observed in the month of August. The pH values at contour 4 also showed monthly fluctuation; minimum pH (8.08) was observed in the month of April while maximum pH (8.47) was observed in the month of August.
Variation in pH values, for samples collected from different layers showed, a rather regular temporal trend, barring few deviations. Figures 3.2 (a-d), 3.3 (a-d) and 3.4 (a-e) show the plots of all three layers. It is observed that the water samples collected from the surface were found to be more alkaline than the samples collected from euphotic and bottom layers. Small differences in pH values for surface, middle and bottom water samples are seen. It is noted that a gradual depth-wise decrease in pH occurs all through the sampling period. In order to observe an overall spatial and temporal variation in the measured pH, a 3-dimensional graph is plotted (Figure 3.5). Plotted pH values represent the average value of samples taken from the three layers. It can be seen that during the month of April-June the pH has low values at all sampling points; pH shows an increase in preceding and subsequent months. Contour 2 showed maximum pH (8.58) value during January 1999.

Conductivity

Observed trends of the measured conductivity at different contours in respective months are shown in Figures 3.6 (a-e). The initial conductivity value measured in January 1999, in the center of the lake (C0), was 0.39 mmho/cm. In subsequent months, a steady increase was observed in conductivity, which registered a maximum value of 0.57 mmho/cm in the month of June. The conductivity showed a steep decrease (0.36 mmho/cm) in the month of July. The conductivity, measured in the months between August and January 2000, showed a periodic fluctuation within a small range. The conductivity, measured at contours 1, 2, 3 and 4, showed a similar qualitative trends.
Minimum conductivity was observed in the month of September and maximum was observed in the month of June throughout the study period.

Figures 3.7 (a-d), 3.8 (a-d) and 3.9 (a-e) showed that bottom water samples had higher conductivity as compared to the surface and middle layer water samples, but no regular trend was discernable between the layers for the measured values of conductivity. Figure 3.10 shows the annual variation in the measured conductivity values at respective contours in 3-dimensional plot. The plotted conductivity values represent an average value of samples taken from different layers. This plot clearly shows a steep rise in the measured conductivity during April-June months.

Total Dissolved Solids (TDS)

The TDS concentration (g/lit) in lake water samples at different contours were measured and the data is plotted in Figures 3.11 (a-e). The TDS values during the study period ranged from 0.18 to 0.43 g/lit. Since conductivity is a function of total dissolved solids, a close similarity was observed in the measured TDS values from month to month with conductivity measurements shown in earlier figures. The initial TDS concentration, measured in January at the center of the lake, was 0.24 g/lit. In the subsequent months, a considerable increase in TDS occurred and it became maximum (0.35 g/lit) in the month of June. In following months, it showed a sharp decrease and a minimum concentration (0.19 g/lit) was observed in the month of September. From the months of October 1999 to January 2000, the fluctuation in the measured values increased, but this variation was
confined to a narrow range. The pattern observed at all other contours was very similar to what was observed at the center of the lake throughout the study period.

The TDS values were found to have little variation across different layers of the different contours, but no regular trend was observed between the layers which is shown in Figures 3.12 (a-d), 3.13 (a-d) and 3.14 (a-e). It was found that the samples collected from the lake bottom, in general, had relatively higher TDS concentration in comparison to the samples collected from the surface and middle layers. Figure 3.15, a 3-dimensional graph, shows the temporal and spatial variation in the measured TDS load. The plot shows that the measured TDS load stays constant during January to March and then there is a sharp increase during April-June and subsequently it decreases. Here, it is significant to note that the measured TDS values in January 1999 were lower than those in January 2000. This observation is further discussed in the next chapter.

Dissolved Oxygen

The lake water maintained fairly good levels of dissolved oxygen (DO) within different layers. For example, the variation in DO was found to be between 5.77 mg/lit to 8.51 mg/lit throughout the study period for water samples taken from the center of the lake. Figure 3.16 (a-e) shows the annual variation in the average concentration of DO (average was taken for the mean of measured values of DO for three layers) at different contours. It can be seen from the figures that the DO concentrations were consistently low during the summer months and significantly higher during the winter months. The
dissolved oxygen measured at contour 1 and 2 also follows the similar pattern, as seen for water samples collected from the center of the lake. At contour 3, the dissolved oxygen reached a high value of 9.23 mg/lit in the month of December and the lowest value (6.03 mg/lit) was observed in the month of May. The pattern observed at contour 4 was very similar to contour 3 except that the minimum concentration (5.9 mg/lit) was observed in the month of April at this site. The maximum dissolved oxygen levels at all contour sites were observed in the month of December 1999. The vertical gradient in dissolved oxygen was comparatively narrow in June as compared to the month of December.

On an average, the DO was found to be more in surface layers throughout the study period. The trends in the variation of measured DO between different layers are shown in Figures 3.17 (a-d), 3.18 (a-d) and 3.19 (a-e). Figure 3.20, a 3-dimensional plot, shows that the overall changes in DO follow a trend. Low DO value occurred in the period April to August 1999. DO was high during January to March 1999 and again during September to January’ 2000.

Inorganic Phosphorous

The initial phosphorous concentration, measured in January 1999 at all five contours of the lake, were considerably low (0.12 to 0.16 mg/lit). At the center of the lake, in the months of January, February and March 1999, comparatively lower phosphorous concentrations (0.15, 0.14 and 0.18 mg/lit respectively) were measured. In subsequent months (June to August), a considerable increase in phosphorous
concentration was observed and it reached maximum (0.42 mg/lit) in the month of July 1999. In September (0.26 mg/lit) and October (0.15 mg/lit), a sharp decrease was observed in phosphorous concentration. Subsequently, from October 1999 to January 2000, the phosphorous concentration observed a steady value between 0.15 to 0.16 mg/lit. The phosphorous concentration measured at contour 1 was qualitatively similar to the trends seen at the center CO [Figures 3.21 (a-b)]. In June and July, maximum concentration (0.41 mg/lit and 0.44 mg/lit respectively) was recorded. In subsequent months, till October, the phosphorous concentration (0.14 mg/lit) decreased significantly. The concentration rose again in the month of November and in subsequent months, it showed variation within a narrow range. Contour 2 samples showed continuous increase in phosphorus concentration from January to May (0.12 to 0.42 mg/lit). At this site, the minimum phosphorous concentration (0.12 mg/lit) was observed in the month of January 1999 and a very broad maxima, covering the months of May to August (0.42 - 0.43 mg/lit), was observed. In subsequent months, the observed pattern of phosphorous concentration was similar to the samples collected from the center of the lake [Figure 3.21 (c)]. The phosphorous measured at contour 3 showed a very less change in the magnitude and in the pattern compared to what was observed at contour 1 [Figure 3.21 (d)]. The measured phosphorous at this site was minimum in the month of February (0.14 mg/lit), as compared to contour 1, where the minimum was observed in January 1999. The value here was found to be maximum in the month of July (0.42 mg/lit). Phosphorous concentration, in subsequent months, showed similar trend as observed at contour 1. Same trends were observed for contour 4 of the lake [Figure 3.21 (e)].
Between different layers, very little variation in phosphorus concentration was observed. However, phosphorous concentration was found to be relatively high in the bottom layer than the water samples from the middle and surface layers during most of the sampling period [Figures 3.22 (a-d), 3.23 (a-d) and 3.24 (a-e)]. Overall spatial and temporal variation in the measured average phosphorus concentration, has been plotted in Figure 3.25, in 3-dimensional graphic form. The trends clearly indicate that the measured phosphorus amount shows increased values between April-September. Along different contours, not much significant change in phosphorous could be seen.

**Nitrate Nitrogen**

The nitrate measured in lake water samples at different sites was estimated; the data is plotted in Figures 3.26 (a-e). At the center of the lake, the nitrate concentration showed a decrease from the month of January 1999 to February 1999 (0.68 mg/lit to 0.58 mg/lit), but in subsequent months, nitrate concentration registered an increase and reached the maximum value of 1.12 mg/lit in July. In August, there was a sharp decrease in the concentration of nitrate corresponding to July. In subsequent months, the concentration of nitrate increased in September and after that it kept decreasing till January 2000 [Figure 3.26 (a)]. Water samples from contour 1 showed minimum nitrate concentration (0.58 mg/lit) in January 2000 and registered a maximum nitrate concentration (1.11 mg/lit) in the month of July. The nitrate concentration measured at contour 2 followed the similar pattern, as seen in the case of water samples taken from the center of the lake. Low nitrate concentration (0.60 mg/lit) was observed in January 2000 and maximum in
the month of July (1.15 mg/lit). The nitrate concentration measured at contour 3 and contour 4 were qualitatively similar to the trends seen for contours 0,1 and 2. The maximum concentration of nitrate (1.13 mg/lit) was registered in the month of July and minimum nitrate concentration (0.57 mg/lit) was measured in January 2000 at the contour 3 of the lake. At contour 4, the minimum value of nitrate concentration (0.59 mg/lit) was recorded in January 2000, whereas maximum (1.15 mg/lit) was recorded in the month of July 1999.

Variation of nitrate concentration between the water samples taken from different layers was small, but it was found that samples collected from the lake bottom always had relatively higher nitrate concentration; this is depicted in Figures 3.27 (a-d), 3.28 (a-d) and 3.29 (a-e). The three dimensional graph, plotted in Figure 3.30, shows that the measured nitrate concentration is independent of the contour, but has a strong temporal dependence. Sudden decrease in measured nitrate concentration in August is an interesting observation, and this is further discussed in the next chapter.

**Protein**

Total protein present in the water samples for a thirteen month period were estimated and the results are shown in Figures 3.31 (a-e). The total protein concentration was found to be low and it varied in a narrow range. Qualitative trends, observed for samples collected from the center of the lake, showed an increase in total protein concentration between January to February 1999 (18.82 μg/lit to 23.69 μg/lit). The
protein concentration variation was found to be in narrow range in the subsequent months. However, the protein concentration in the month of December 1999 and January 2000 underwent a sharp increase. The maximum protein concentration (31.9 µg/lit) was observed in January 2000. The broad trends of total protein, estimated for samples taken from different contours, showed a similar qualitative pattern [Figures 3.31 (a-e)].

The concentration of protein in the middle and lower strata of water column was found to be not much different from the surface concentrations. Here also, no regular trend was observed between the layers for the measured values of protein. The protein concentration, its variation, between different layers and different contours are shown in Figures 3.32 (a-d), 3.33 (a-d) and 3.34 (a-e). The overall temporal change in total protein concentration shows a steady rising trend throughout the study period (Figure 3.35).

Chlorophyll a

For the estimation of chlorophyll a, monthly measurement was done over a thirteen-month period for five selected contours of the lake. These trends are plotted in Figures 3.36 (a-e). At the center of the lake, measured chlorophyll a concentration showed a steady increase from January 1999 to April 1999 (0.023 mg/m³ to 0.039 mg/m³). But in subsequent months, chlorophyll a concentration showed a sharp increase and reached the maximum value of 0.073 mg/m³ in the month of June. In July, there was a sharp decrease in the amount of chlorophyll a (0.044 mg/m³). In subsequent months, the concentration increased, but again showed a decrease in September. The value rose
again in the month of October. During November and December, chlorophyll \( a \) concentration decreased to 0.037 mg/m\(^3\) and 0.029 mg/m\(^3\) respectively, and this was followed by the increase in chlorophyll \( a \) concentration in January 2000. The highest concentration of chlorophyll \( a \) was 0.073 mg/m\(^3\) in the month of June and minimum 0.023 mg/m\(^3\) was measured in January 1999 at the center of the lake. At contour 1, the concentration of chlorophyll \( a \) was minimum (0.028 mg/m\(^3\)) in March and maximum (0.081 mg/m\(^3\)) in the month of June. The chlorophyll \( a \) concentration measured at contour 2 showed a little change in magnitude as compared to the trends at contour 1. At contour 3, the minimum chlorophyll \( a \) concentration (0.021 mg/m\(^3\)) was recorded in December, whereas maximum (0.081 mg/m\(^3\)) was found in the month of June. The pattern observed at contour 4 was very similar to contour 3 except that the minimum concentration was observed during the month of February at this site and the variation from month to month was confined to a narrow range.

The chlorophyll \( a \) concentration followed a nearly identical pattern of seasonal changes at all five sampling sites during the study period. The concentration of chlorophyll \( a \) remained low during winter, but increased with the onset of summer and reached the peak during June. The chlorophyll \( a \) concentration decreased sharply thereafter, during the rainy season. The concentration of chlorophyll \( a \) in the middle and lower depths of water column was not found to be much different from the surface concentrations. No regular trend was seen between the layers for the measured concentration of chlorophyll \( a \).
The chlorophyll $a$ concentration, its variation between different layers and different contours is shown in Figures 3.37 (a-d), 3.38 (a-d) and 3.39 (a-e). Measured chlorophyll $a$ overall trends, spatial and temporal, are shown in Figure 3.40 in a 3-dimensional plot. There is a significant variation in chlorophyll $a$ from contour to contour. At the same time, temporal variation can also be seen. Measured chlorophyll $a$ was low during winter months as compared to the summer months.

**Spectral Analysis of Water Samples**

Water samples collected from each layer were subjected to spectral analysis in the wavelength span of 250-700 nm. The analysis of digital spectral values of each sample were subjected to non-linear regression analysis by using the functional form (Chapter 2) for $n$ components. The selection of components was done on the basis of COD, SSD, RMS and MSC (Appendix I). The next stage involved the plots of experimental absorbance values and fitted values on the same graph. The drawn graph has three parts (Figures 3.41 to 3.66): (1) spectral de-convolution of fitted spectral curve in the analyzed wavelength range, (2) spectral fit through the measured absorbance values of the samples at respective wavelength and (3) plot of residuals between fitted and experimental values. For clarity, an attempt has been made to represent different curves in different colours. Each figure also provides relevant information on the calculated parameters to evaluate the estimates on the respective relative concentration of each component. SFP analysis results in a very large number of figures; to maintain brevity, the figures presented in the thesis show the analysis of experimental spectral values for surface water samples, for the
contour C0 and C4 only. For convenience, all representative composite figures related to SFP analysis, are given continuously from page 108 to 133, after this text. To ensure the presentation of complete SFP results, the calculated parameter values for all the respective samples are given in Tables 3.5 to 3.9 from page 134 to 138. The respective tables show the calculated relative concentration of each fitted component and their proportion (%) with respect to the total concentration. Total concentration CT correspond to the concentration summation of n components in the given spectral span. The calculations of CT and the respective individual components (C1, C2, ..., Ci) is based on the use of equations 1, 2 and 3, as given in Chapter 2. The calculated values of respective fitted parameters (Cmax, Dispersion Coefficient, Peak position, COD and SSD), for each fit for analyzed water samples, are also given in tabular form in Appendix II. Complete analysis, using SFP, was done on all samples (surface, euphotic depth and bottom) over the period of thirteen months.

Relative concentrations of respective de-convoluted components show spatial and temporal variation in water samples. These changes are plotted in graph form (Figure 3.67 to 3.71) for all samples collected from the surface at contour C0 to C4. These plots are subsequently used for comparison with the variation seen in the chemical analysis done on these samples. The spectral response of a given water sample depends on the presence of different absorbing chemical groups in dissolved form. The absorption profile of each de-convoluted component represents a broad class of compounds absorbing in a specific wavelength span. Indirect assessment of such groups can be assigned to the respective...
fingerprints while comparing them to the results of chemical analysis. Appendix III (a and b) provides the broad representation of absorption profile of such chemical compounds and groups.

The minimum number of components, required to fit the spectral data, were found to be 5. As mentioned above, each of these components are plotted in the representative Figures (3.41 to 3.66). The first peak positions for these fitted component occur, broadly, below 150 nm. This apparent peak may not have much significance from the point of view of actual interpretation of useful information. It is well known that even the presence of oxygen and salt groups in aqueous samples will result in strong absorbance. The total integrated concentration confined in this component is found to be relatively small (Appendix II). The second peak is found to occur in the range of 240-280 nm. This peak position has a strong correlation with the presence of biomolecules in aqueous samples (protein, polypeptide, nucleic acids etc.). The third and fourth peak position is found between 300-500 nm. The presence of long chained organic groups attached to metal ions will absorb in this range. The fifth peak position is found to occur above 800 nm. Another aspect, different with this peak, is the peak spread. It is found that absorption range is well spread over the whole spectral range used in the present study (250-700 nm). This kind of absorption spread is owed to the presence of small particulate in samples which result in the scattering of light rather than the absorbance. The scattered light causes a decrease in the light and is measured indirectly as absorbance. It is found that the integrated concentration, more often, is maximally distributed between component 2 to
component 5. This strongly indicate the presence of biomolecules, organic groups and suspended particulate in the water samples. The overall fit of the model, based on the COD, was found to be excellent. Also, the sum of squared deviation of the fit was found to be less than 0.006. The residual plots, indicating the difference between measured spectral values and fitted values, were found to be within ±0.05.

Calculated integrated concentrations of individual concentration (C1-C5) for 13 months (January 1999- January 2000) are plotted in Figures 3.67 to 3.71. These figures correspond only to the surface samples. However, the complete information on the concentration of all components for water samples, taken from surface, euphotic depth and bottom of the lake, are given in tabular form in Tables 3.5 to 3.9. C1 component, the smallest component in terms of the magnitude, has low values in January 1999 and shows an increase in July onwards and decreases again in January 2000. The variation in C1 does not show any predictable trend. The plotted values of C2-C4, representing the composite mixture of biomolecules, organic material and metal conjugated complexes in totality correspond to the maximum concentration proportion of the total (CT). No clear trend could be obtained from the annual plotted values of these components. However, it is observed that in general the values show an overall increasing monthly trend.

The plotted values of C5, one of the largest components, corresponded to the presence of suspended particulate, as explained above. The variation seen in C5 over the
study period also does not show any systematic trend, but an overall increase in the magnitude of C5 can be perceived. CT plots also shows a consistent increase in values over the study period.

**Coupling SFP with Physico-Chemical Analysis:**

The use of SFP method does provide unique spectral signature to the water samples at a given time. By itself, SFP can be used to assess temporal alterations in the status of dissolved constituents in the water samples, but it is also essential to seek their (SFP's) correlation with chemical and physical attributes of the same samples. The results presented on conductivity and TDS (total dissolved solids) were used to establish correlation, if any, with the integrated concentration of respective SFP component. This analysis did establish a link between SFP components and the measured corresponding values of TDS and conductivity of the same water samples. Correlation analysis results indicate that the SFP components 2 and 3 have a positive weak correlation with TDS values over a period of 13 months (Corr. 0.08 - 0.54).
Annual pH Trend at Different Contours (c0-c4) of the Lake

Figure: 3.1 (a-e) Months
pH Measured at Different Layers of Selected Contours

(a) Jan'99

(b) Feb'99

(c) Mar'99

(d) Apr'99

Figure: 3.2 (a-d)
Figure: 3.3 (a-d) Contours
Figure 3.4 (a-e)

pH Measured at Different Layers of Selected Contours

- (a) Sep'99
- (b) Oct'99
- (c) Nov'99
- (d) Dec'99
- (e) Jan'2000

Contours

PH
Annual pH Variation at Different Contours of the Lake

Figure: 3.5
Annual Conductivity Trend at Different Contours (c0-c4) of the Lake

Figure: 3.6 (a-e)
Conductivity Measured at Different Layers of Selected Contours

Figure: 3.8 (a-d) Contours
Conductivity Measured at Different Layers of Selected Contours

Figure: 3.9 (a-e)
Figure: 3.10

Annual Conductivity Variation at Different Contours

Conductivity in mho/cm

Contours
Figure: 3.11 (a-e)

Annual Total Dissolved Solids Variation at Different Contours

(a) c0

(b) c1

(c) c2

(d) c3

(e) c4

Months

Total Dissolved Solids in g/lit
Total Dissolved Solids Measured at Different Layers of Selected Contours

Figure: 3.12 (a-d)
Total Dissolved Solids Measured at Different Layers of Selected Contours

Figure: 3.13 (a-d)
Total Dissolved Solids Measured at Different Layers of Selected Contours

(a) Sep' 99
(b) Oct' 99
(c) Nov' 99
(d) Dec' 99
(e) Jan' 2000

Figure: 3.14 (a-e)
Annual Total Dissolved Solids Variation at Different Contours

Figure: 3.15
Annual Dissolved Oxygen Trend at Different Contours (c0-c4) of the Lake

Figure 3.16 (a-e)
Dissolved Oxygen Measured at Different Layers of Selected Contours

Figure: 3.17 (a-d)
Dissolved Oxygen Measured at Different Layers of Selected Contours

Figure: 3.18 (a-d)
Dissolved Oxygen Measured at Different Layers of Selected Contours

(a) Sep'99
(b) Oct'99
(c) Nov'99
(d) Dec'99
(e) Jan'2000

Figure: 3.19 (a-e)
Annual Dissolved Oxygen Concentration Variation at Different Contours

Figure: 3.20
Annual Phosphate Trend at Different Contours (c0-c4) of the Lake

Figure: 3.21 (a-e)
Phosphate Concentration Measured at Different Layers of Selected Contours

Figure: 3.22 (a-d) Contours
Phosphate Concentration Measured at Different Layers of Selected Contours

Figure: 3.23 (a-d)
Phosphate Concentration Measured at Different Layers of Selected Contours

Figure: 3.24 (a-e)
Annual Nitrate Trend at Different Contours (c0-c4) of the Lake

Figure: 3.26 (a-e)
Nitrate Concentration Measured at Different Layers of Selected Contours

Figure: 3.27 (a-d)
Nitrate Concentration Measured at Different Layers of Selected Contours

Figure: 3.28 (a-d)
Nitrate Concentration Measured at Different Layers of Selected Contours

(a) Sep'99

(b) Oct'99

(c) Nov'99

(d) Dec'99

(e) Jan'2000

Contour in mg/lit

Figure: 3.29 (a-e)
Annual Nitrate Concentration Variation at Different Contours

Figure: 3.30
Annual Protein Trend at Different Contours (c0-c4) of the Lake

Figure: 3.31 (a-e)
Protein Concentration Measured at Different Layers of Selected Contours

Figure: 3.32 (a-d) Contours
Protein Concentration Measured at Different Layers of Selected Contours

Figure: 3.33 (a-d) Contours
Protein Concentration Measured at Different Layers of Selected Contours

Figure: 3.34 (a-e)
Annual Protein Concentration Variation at Different Contours

Figure: 3.35
Annual Chlorophyll a Trend at Different Contours (c0-c4) of the Lake

Figure: 3.36 (a-e)
Chlorophyll a Concentration Measured at Different Layers of Selected Contours

(a) Jan'99

(b) Feb'99

(c) Mar'99

(d) Apr'99

Figure: 3.37 (a-d)
Chlorophyll a Concentration Measured at Different Layers of Selected Contours

Figure: 3.38 (a-d) Contours
Chlorophyll a Concentration Measured at Different Layers of Selected Contours

Figure: 3.39 (a-e)
Annual Chlorophyll a Concentration Variation at Different Contours

Figure: 3.40
Sample: Surface Layer
Contour: C0
Month & Year: Jan' 99

**Spectral De-convolution**

- C1 (0.40)
- C2 (13.54)
- C3 (0.18)
- C4 (4.39)
- C5 (11.4)
- CT (29.97)

**Fitted Spectra**

+++ Sample Spectra
- Fitted model

**Statistics of the Fit:**

- $\text{SSD} = 2.93732461 \times 10^{-4}$
- $\text{SDEV} = 1.12974023 \times 10^{-5}$
- $\text{COD} = 0.99951964$

**Residual Plot**

- Experimental - Fitted

Figure: 3.41
Sample: Surface Layer
Contour: C4
Month & Year: Jan' 99

Spectral De-convolution

Fitted Spectra

Spectral De-convolution

Fitted Spectra

SSD = 0.00177017
SDEV = 6.80834159 \times 10^{-5}
COD = 0.99438807

Residual Plot

Figure: 3.42
Sample: Surface Layer  
Contour: CO  
Month & Year: Feb' 99

![Spectral De-convolution](image1)

![Fitted Spectra](image2)

**Statistics of the Fit:**
- \( SSD = 1.91107828 \times 10^{-4} \)
- \( SDEV = 7.3503011 \times 10^{-6} \)
- \( COD = 0.99908304 \)

![Residual Plot](image3)

**Figure: 3.43**
Sample: Surface Layer
Contour: C4
Month & Year: Feb' 99

Sample Spectra
Fitted Model

Statistics of the Fit:
SSD = 2.58559191 \cdot 10^{-4}
SDEV = 9.94458428 \cdot 10^{-6}
COD = 0.99863682

Figure: 3.44
Sample: Surface Layer
Contour: C0
Month & Year: March’ 1999

Figure: 3.45
Sample: Surface Layer
Contour: C4
Month & Year: March' 99

Spectral De-convolution Fitted Spectra

Statistics of the Fit:
SSD = 5.60666315 × 10^{-4}
SDEV = 2.1564089 × 10^{-5}
COD = 0.99813103

Figure: 3.46
Sample: Surface Layer
Contour: C0
Month & Year: April' 1999

Spectral De-convolution Fitted Spectra

Statistics of the Fit:
SSD = 4.21028802 \times 10^{-4}
SDEV = 1.61934155 \times 10^{-5}
COD = 0.99946854

Residual Plot

Figure: 3.47
Sample: Surface Layer  
Contour: C4  
Month & Year: April' 1999

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:
SSD = 6.39263513\times10^{-4}
SDEV = 2.45870582\times10^{-5}
COD = 0.99885943

Figure: 3.48
Sample: Surface Layer
Contour: C0
Month & Year: May' 99

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:
SSD = 2.04087278 \times 10^{-4}
SDEV = 7.84951071 \times 10^{-6}
COD = 0.99965566

Residual Plot

Figure: 3.49
Sample: Surface Layer
Contour: C4
Month & Year: May' 99

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:
SSD = 7.67136412 \times 10^{-4}
SDEV = 2.95052466 \times 10^{-5}
COD = 0.99909322

Residual Plot

Figure: 3.50
Spectral De-convolution Fitted Spectra

Figure: 3.51

Sample: Surface Layer
Contour: C0
Month & Year: June' 99

Statistics of the Fit:
SSD = 0.0022878
SDEV = 8.79921835 \times 10^{-5}
COD = 0.99543138
Sample: Surface Layer  
Contour: C4  
Month & Year: June' 99

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:

SSD = 5.53198072 \times 10^{-4} 
SDEV = 2.12768489 \times 10^{-5} 
COD = 0.99861027

Figure: 3.52
Sample: Surface Layer
Contour: C0
Month & Year: July' 99

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:
SSD = 1.08263769 × 10^{-4}
SDEV = 4.16399112 × 10^{-6}
COD = 0.99955538

Residual Plot

Experimental - Fitted

Figure: 3.53
Sample: Surface Layer
Contour: C4
Month & Year: July' 1999

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:
SSD = 3.15353777 \times 10^{-4}
SDEV = 1.21289914 \times 10^{-5}
COD = 0.9990107

Figure: 3.54
Sample: Surface Layer
Contour: C0
Month & Year: Aug' 99

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:
SSD = 3.73498174 \cdot 10^{-4}
SDEV = 1.43653144 \cdot 10^{-5}
COD = 0.99871128

Residual Plot

Figure: 3.55
Sample: Surface Layer
Contour: C4
Month & Year: Aug' 99

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:
SSD = 3.25424375 · 10^{-4}
SDEV = 1.25163221 · 10^{-5}
COD = 0.99909165

Residential Plot

Figure: 3.56
Sample: Surface Layer  
Contour: C0  
Month & Year: Sep’ 99

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:
SSD = 1.53092471 \times 10^{-4}  
SDEV = 5.88817196 \times 10^{-6}  
COD = 0.99972508

Residual Plot

Figure: 3.57

Figure: 3.57
Sample: Surface Layer
Contour: C4
Month & Year: Sep'99

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:
SSD = 3.44315185 \times 10^{-4}
SDEV = 1.32428917 \times 10^{-5}
COD = 0.99957907

Residual Plot

Figure: 3.58
Sample: Surface Layer
Contour: C0
Month & Year: Oct' 99

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:
SSD = 2.05964698 \times 10^{-4}
SDEV = 7.92171916 \times 10^{-6}
COD = 0.99967655

Residual Plot

Figure: 3.59

126
Sample: Surface Layer
Contour: C4
Month & Year: Oct' 99

Spectral De-convolution Fitted Spectra

![Graph showing spectral de-convolution and fitted spectra.]

- C1 (0.86)
- C2 (13.73)
- C3 (0.54)
- C4 (4.57)
- C5 (25.356)
- CT (45.04)

Fitted Spectra

![Graph showing fitted spectra.]

- *** Sample Spectra
- Fitted Model

**Statistics for the Fit:**
SSD = 3.02675223 \times 10^{-4}
SDEV = 1.16413547 \times 10^{-5}
COD = 0.99957899

Residual Plot

![Graph showing residual plot.]

- Experimental - Fitted

**Figure: 3.60**
Sample: Surface Layer  
Contour: C0  
Month & Year: Nov' 99

Spectral De-convolution

![Spectral De-convolution Graph](image)

Fitted Spectra

![Fitted Spectra Graph](image)

Statistics for the Fit:

- SSD = 3.20487023 \cdot 10^{-4}
- SDEV = 1.23264240 \cdot 10^{-5}
- COD = 0.99980398

Residual Plot

![Residual Plot Graph](image)

Figure: 3.61
Sample: Surface Layer
Contour: C4
Month & Year: Nov' 99

![Graphs showing spectral de-convolution and fitted spectra.](image)

Spectral De-convolution Fitted Spectra

Statistics of the Fit:
SSD = 7.81513469 \times 10^{-4}
SDEV = 3.00582103 \times 10^{-5}
COD = 0.99963536

Residual Plot

Figure: 3.62
Sample: Surface Layer  
Contour: C0  
Month & Year: Dec' 99

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:
SSD = 0.00164939
SDEV = 6.34380036·10^-5
COD = 0.99909489

Residual Plot

Figure: 3.63
Sample: Surface Layer
Contour: C4
Month & Year: Dec' 99

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:
SSD = 0.00178208
SDEV = 6.85414403 \times 10^{-5}
COD = 0.99955485

Residual Plot

Figure: 3.64

131
Sample: Surface Layer
Contour: C0
Month & Year: Jan' 2000

Spectral De-convolution

Fitted Spectra

Statistics of the Fit:
SSD = 0.00581022
SDEV = 2.23469983 \times 10^{-4}
COD = 0.994055

Figure: 3.65
Sample: Surface Layer
Contour: C4
Month & Year: Jan' 2000

Statistics of the Fit:
SSD = 0.00359802
SDEV = 1.38385193 \times 10^{-4}
COD = 0.99871948

Figure: 3.66
<table>
<thead>
<tr>
<th>Sites</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan2k</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0.40</td>
<td>0.30</td>
<td>0.37</td>
<td>0.38</td>
<td>0.26</td>
<td>0.00</td>
<td>0.45</td>
<td>0.15</td>
<td>0.39</td>
<td>0.79</td>
<td>0.62</td>
<td>0.19</td>
<td>0.04</td>
</tr>
<tr>
<td>C2</td>
<td>13.54</td>
<td>4.40</td>
<td>16.98</td>
<td>18.48</td>
<td>4.53</td>
<td>29.24</td>
<td>1.03</td>
<td>7.80</td>
<td>8.95</td>
<td>11.76</td>
<td>20.53</td>
<td>4.26</td>
<td>27.37</td>
</tr>
<tr>
<td>C3</td>
<td>0.178</td>
<td>0.72</td>
<td>1.00</td>
<td>1.09</td>
<td>2.0</td>
<td>0.61</td>
<td>0.65</td>
<td>0.67</td>
<td>1.01</td>
<td>1.17</td>
<td>1.83</td>
<td>1.57</td>
<td>0.36</td>
</tr>
<tr>
<td>CS</td>
<td>4.39</td>
<td>2.39</td>
<td>2.76</td>
<td>3.07</td>
<td>6.27</td>
<td>1.56</td>
<td>1.99</td>
<td>2.08</td>
<td>2.90</td>
<td>6.08</td>
<td>6.08</td>
<td>5.35</td>
<td>4.71</td>
</tr>
<tr>
<td>C5</td>
<td>11.4</td>
<td>5.26</td>
<td>11.1</td>
<td>7.15</td>
<td>4.84</td>
<td>14.40</td>
<td>15.64</td>
<td>12.30</td>
<td>4.96</td>
<td>16.11</td>
<td>6.09</td>
<td>9.25</td>
<td>10.96</td>
</tr>
<tr>
<td>CT</td>
<td>29.97</td>
<td>13.07</td>
<td>32.73</td>
<td>30.16</td>
<td>21.48</td>
<td>47.20</td>
<td>19.15</td>
<td>26.54</td>
<td>18.58</td>
<td>33.12</td>
<td>31.28</td>
<td>40.25</td>
<td>44.91</td>
</tr>
<tr>
<td>C1</td>
<td>0.46</td>
<td>0.04</td>
<td>0.80</td>
<td>0.04</td>
<td>0.02</td>
<td>0.75</td>
<td>2.64</td>
<td>0.59</td>
<td>0.53</td>
<td>0.53</td>
<td>0.023</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>C2</td>
<td>21.15</td>
<td>3.74</td>
<td>9.46</td>
<td>8.34</td>
<td>3.15</td>
<td>19.89</td>
<td>7.09</td>
<td>19.36</td>
<td>0.58</td>
<td>23.78</td>
<td>26.31</td>
<td>25.29</td>
<td>58.89</td>
</tr>
<tr>
<td>C3</td>
<td>0.23</td>
<td>0.88</td>
<td>0.85</td>
<td>1.23</td>
<td>7.81</td>
<td>1.52</td>
<td>0.99</td>
<td>0.80</td>
<td>8.75</td>
<td>9.88</td>
<td>1.30</td>
<td>1.66</td>
<td>1.36</td>
</tr>
<tr>
<td>C4</td>
<td>3.60</td>
<td>3.75</td>
<td>2.55</td>
<td>7.12</td>
<td>2.69</td>
<td>2.64</td>
<td>1.77</td>
<td>2.71</td>
<td>7.51</td>
<td>4.87</td>
<td>5.12</td>
<td>6.39</td>
<td>14.87</td>
</tr>
<tr>
<td>C5</td>
<td>12.5</td>
<td>11.65</td>
<td>5.06</td>
<td>15.73</td>
<td>11.68</td>
<td>1.14</td>
<td>1.14</td>
<td>1.14</td>
<td>1.14</td>
<td>1.14</td>
<td>1.14</td>
<td>1.14</td>
<td>1.14</td>
</tr>
<tr>
<td>CT</td>
<td>38.00</td>
<td>20.04</td>
<td>18.72</td>
<td>32.66</td>
<td>20.21</td>
<td>35.52</td>
<td>5.41</td>
<td>24.30</td>
<td>29.49</td>
<td>22.26</td>
<td>35.31</td>
<td>40.79</td>
<td>42.97</td>
</tr>
<tr>
<td>C1</td>
<td>0.37</td>
<td>0.08</td>
<td>0.04</td>
<td>0.04</td>
<td>0.58</td>
<td>2.28</td>
<td>0.12</td>
<td>0.17</td>
<td>0.56</td>
<td>0.56</td>
<td>0.56</td>
<td>0.56</td>
<td>0.048</td>
</tr>
<tr>
<td>C2</td>
<td>2.27</td>
<td>2.81</td>
<td>15.53</td>
<td>17.49</td>
<td>1.52</td>
<td>22.30</td>
<td>0.54</td>
<td>18.93</td>
<td>22.05</td>
<td>22.24</td>
<td>22.93</td>
<td>24.45</td>
<td>47.45</td>
</tr>
<tr>
<td>C3</td>
<td>0.70</td>
<td>0.87</td>
<td>1.16</td>
<td>1.31</td>
<td>0.95</td>
<td>0.75</td>
<td>0.97</td>
<td>0.97</td>
<td>1.46</td>
<td>1.69</td>
<td>1.69</td>
<td>1.69</td>
<td>1.69</td>
</tr>
<tr>
<td>C4</td>
<td>3.00</td>
<td>2.07</td>
<td>3.35</td>
<td>4.35</td>
<td>2.52</td>
<td>6.10</td>
<td>3.31</td>
<td>3.54</td>
<td>3.90</td>
<td>4.08</td>
<td>4.08</td>
<td>4.08</td>
<td>4.08</td>
</tr>
<tr>
<td>C5</td>
<td>6.31</td>
<td>11.39</td>
<td>11.47</td>
<td>12.60</td>
<td>11.50</td>
<td>17.45</td>
<td>14.59</td>
<td>8.38</td>
<td>5.11</td>
<td>5.64</td>
<td>8.03</td>
<td>9.68</td>
<td>22.85</td>
</tr>
<tr>
<td>CT</td>
<td>19.64</td>
<td>17.14</td>
<td>31.98</td>
<td>36.02</td>
<td>22.55</td>
<td>38.31</td>
<td>21.90</td>
<td>27.50</td>
<td>32.73</td>
<td>22.70</td>
<td>33.20</td>
<td>41.55</td>
<td>42.36</td>
</tr>
</tbody>
</table>
Table 3.6: Concentrations of Individual Components from SFP for Contour 1 of the Lake

<table>
<thead>
<tr>
<th>Sites</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan2k</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sur</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sites</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan2k</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0.37</td>
<td>0.03</td>
<td>0.56</td>
<td>0.25</td>
<td>0.17</td>
<td>0.63</td>
<td>0.29</td>
<td>0.15</td>
<td>0.11</td>
<td>0.31</td>
<td>0.71</td>
<td>0.73</td>
<td>0.0004</td>
</tr>
<tr>
<td>Sur</td>
<td>9.32</td>
<td>3.50</td>
<td>14.93</td>
<td>17.91</td>
<td>6.12</td>
<td>20.75</td>
<td>0.87</td>
<td>1.23</td>
<td>3.62</td>
<td>24.87</td>
<td>27.24</td>
<td>28.42</td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>3.38</td>
<td>1.59</td>
<td>3.11</td>
<td>3.42</td>
<td>7.42</td>
<td>4.46</td>
<td>0.98</td>
<td>0.46</td>
<td>3.00</td>
<td>17.95</td>
<td>28.33</td>
<td>29.51</td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td>6.31</td>
<td>11.64</td>
<td>10.74</td>
<td>9.22</td>
<td>10.28</td>
<td>12.44</td>
<td>11.15</td>
<td>15.62</td>
<td>15.19</td>
<td>5.90</td>
<td>7.83</td>
<td>26.67</td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td>20.01</td>
<td>17.53</td>
<td>30.48</td>
<td>31.92</td>
<td>30.30</td>
<td>37.75</td>
<td>16.77</td>
<td>28.72</td>
<td>12.48</td>
<td>32.82</td>
<td>37.03</td>
<td>41.51</td>
<td>61.69</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sites</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan2k</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0.14</td>
<td>0.05</td>
<td>0.19</td>
<td>0.38</td>
<td>0.20</td>
<td>0.62</td>
<td>0.05</td>
<td>0.05</td>
<td>0.13</td>
<td>0.40</td>
<td>0.82</td>
<td>0.73</td>
<td>0.009</td>
</tr>
<tr>
<td>Mid</td>
<td>7.79</td>
<td>4.47</td>
<td>8.40</td>
<td>10.89</td>
<td>6.71</td>
<td>21.61</td>
<td>3.39</td>
<td>17.95</td>
<td>28.33</td>
<td>29.51</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>0.84</td>
<td>0.75</td>
<td>1.10</td>
<td>0.85</td>
<td>0.53</td>
<td>1.44</td>
<td>0.49</td>
<td>0.49</td>
<td>1.75</td>
<td>5.19</td>
<td>0.48</td>
<td>0.41</td>
<td>0.049</td>
</tr>
<tr>
<td>C5</td>
<td>5.23</td>
<td>5.58</td>
<td>7.28</td>
<td>17.61</td>
<td>6.61</td>
<td>12.12</td>
<td>11.82</td>
<td>15.76</td>
<td>15.12</td>
<td>5.71</td>
<td>7.59</td>
<td>25.67</td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td>17.96</td>
<td>12.94</td>
<td>19.46</td>
<td>22.14</td>
<td>26.66</td>
<td>38.61</td>
<td>22.00</td>
<td>12.38</td>
<td>40.16</td>
<td>32.20</td>
<td>37.11</td>
<td>42.24</td>
<td>61.67</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sites</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan2k</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0.18</td>
<td>0.17</td>
<td>0.35</td>
<td>0.33</td>
<td>0.14</td>
<td>0.37</td>
<td>0.44</td>
<td>0.41</td>
<td>0.35</td>
<td>0.31</td>
<td>0.82</td>
<td>0.18</td>
<td>0.058</td>
</tr>
<tr>
<td>Low</td>
<td>10.72</td>
<td>4.94</td>
<td>16.11</td>
<td>19.40</td>
<td>5.42</td>
<td>21.07</td>
<td>15.73</td>
<td>18.24</td>
<td>2.39</td>
<td>31.06</td>
<td>12.81</td>
<td>38.80</td>
<td>0.13</td>
</tr>
<tr>
<td>C4</td>
<td>1.00</td>
<td>0.77</td>
<td>1.13</td>
<td>1.28</td>
<td>0.72</td>
<td>1.43</td>
<td>0.57</td>
<td>0.79</td>
<td>1.04</td>
<td>0.82</td>
<td>0.16</td>
<td>0.46</td>
<td>1.82</td>
</tr>
<tr>
<td>C5</td>
<td>4.32</td>
<td>2.00</td>
<td>3.48</td>
<td>4.19</td>
<td>3.89</td>
<td>2.78</td>
<td>2.86</td>
<td>2.57</td>
<td>5.20</td>
<td>7.30</td>
<td>16.90</td>
<td>15.70</td>
<td>0.394</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sites</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan2k</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>28.71</td>
<td>12.75</td>
<td>31.00</td>
<td>37.28</td>
<td>27.41</td>
<td>38.98</td>
<td>24.79</td>
<td>25.96</td>
<td>31.99</td>
<td>26.24</td>
<td>46.32</td>
<td>55.04</td>
<td>46.17</td>
</tr>
</tbody>
</table>

135
<table>
<thead>
<tr>
<th>Sites</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan2k</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0.43</td>
<td>0.11</td>
<td>0.44</td>
<td>0.27</td>
<td>0.20</td>
<td>0.74</td>
<td>0.16</td>
<td>0.02</td>
<td>0.39</td>
<td>0.67</td>
<td>0.03</td>
<td>4.31</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>(0.92)</td>
<td>(0.67)</td>
<td>(1.88)</td>
<td>(0.78)</td>
<td>(0.59)</td>
<td>(2.38)</td>
<td>(1.62)</td>
<td>(0.07)</td>
<td>(1.31)</td>
<td>(1.92)</td>
<td>(0.07)</td>
<td>(10.6)</td>
<td>(0.74)</td>
</tr>
<tr>
<td></td>
<td>(29.29)</td>
<td>(31.49)</td>
<td>(29.69)</td>
<td>(52.85)</td>
<td>(22.84)</td>
<td>(54.54)</td>
<td>(30.29)</td>
<td>(10.24)</td>
<td>(48.40)</td>
<td>(58.30)</td>
<td>(59.91)</td>
<td>(54.08)</td>
<td>(48.24)</td>
</tr>
<tr>
<td>C3</td>
<td>7.86</td>
<td>0.89</td>
<td>6.67</td>
<td>1.15</td>
<td>9.84</td>
<td>1.54</td>
<td>0.41</td>
<td>0.76</td>
<td>0.92</td>
<td>1.13</td>
<td>1.85</td>
<td>5.68</td>
<td>1.55</td>
</tr>
<tr>
<td></td>
<td>(16.80)</td>
<td>(5.42)</td>
<td>(28.49)</td>
<td>(3.33)</td>
<td>(8.36)</td>
<td>(4.15)</td>
<td>(2.81)</td>
<td>(3.09)</td>
<td>(3.23)</td>
<td>(8.94)</td>
<td>(3.68)</td>
<td>(9.34)</td>
<td>(3.68)</td>
</tr>
<tr>
<td>Sur</td>
<td>C4</td>
<td>4.18</td>
<td>2.39</td>
<td>5.42</td>
<td>4.09</td>
<td>9.70</td>
<td>2.86</td>
<td>3.22</td>
<td>6.11</td>
<td>3.43</td>
<td>3.27</td>
<td>2.01</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>(8.94)</td>
<td>(14.56)</td>
<td>(23.15)</td>
<td>(11.84)</td>
<td>(28.45)</td>
<td>(9.21)</td>
<td>(32.62)</td>
<td>(22.58)</td>
<td>(11.53)</td>
<td>(9.36)</td>
<td>(4.74)</td>
<td>(0.02)</td>
<td>(26.68)</td>
</tr>
<tr>
<td>C5</td>
<td>20.60</td>
<td>7.87</td>
<td>3.93</td>
<td>10.78</td>
<td>6.58</td>
<td>8.98</td>
<td>3.08</td>
<td>17.40</td>
<td>10.61</td>
<td>9.50</td>
<td>13.10</td>
<td>20.83</td>
<td>9.00</td>
</tr>
<tr>
<td></td>
<td>(44.04)</td>
<td>(47.93)</td>
<td>(16.79)</td>
<td>(31.20)</td>
<td>(19.30)</td>
<td>(28.91)</td>
<td>(31.21)</td>
<td>(64.30)</td>
<td>(35.66)</td>
<td>(27.19)</td>
<td>(30.91)</td>
<td>(36.07)</td>
<td>(21.35)</td>
</tr>
<tr>
<td>CT</td>
<td>46.78</td>
<td>16.42</td>
<td>23.41</td>
<td>34.55</td>
<td>34.10</td>
<td>31.06</td>
<td>9.87</td>
<td>27.06</td>
<td>29.75</td>
<td>34.94</td>
<td>42.38</td>
<td>57.75</td>
<td>42.16</td>
</tr>
<tr>
<td>C2</td>
<td>0.26</td>
<td>0.19</td>
<td>0.08</td>
<td>0.23</td>
<td>0.10</td>
<td>0.37</td>
<td>0.33</td>
<td>0.32</td>
<td>0.40</td>
<td>0.94</td>
<td>0.043</td>
<td>(1.02)</td>
<td>(0.096)</td>
</tr>
<tr>
<td></td>
<td>(0.27)</td>
<td>(0.13)</td>
<td>(0.36)</td>
<td>(1.33)</td>
<td>(0.26)</td>
<td>(1.33)</td>
<td>(1.33)</td>
<td>(1.33)</td>
<td>(1.33)</td>
<td>(1.33)</td>
<td>(1.33)</td>
<td>(1.33)</td>
<td>(1.33)</td>
</tr>
<tr>
<td>C3</td>
<td>4.58</td>
<td>0.45</td>
<td>2.73</td>
<td>0.99</td>
<td>8.95</td>
<td>1.37</td>
<td>4.10</td>
<td>0.74</td>
<td>0.88</td>
<td>0.69</td>
<td>1.69</td>
<td>0.44</td>
<td>(1.95)</td>
</tr>
<tr>
<td></td>
<td>(17.95)</td>
<td>(4.89)</td>
<td>(4.46)</td>
<td>(3.61)</td>
<td>(3.61)</td>
<td>(3.61)</td>
<td>(3.61)</td>
<td>(3.61)</td>
<td>(3.61)</td>
<td>(3.61)</td>
<td>(3.61)</td>
<td>(3.61)</td>
<td>(3.61)</td>
</tr>
<tr>
<td>Mid</td>
<td>C4</td>
<td>2.00</td>
<td>2.48</td>
<td>0.54</td>
<td>3.32</td>
<td>7.97</td>
<td>3.47</td>
<td>4.85</td>
<td>5.60</td>
<td>3.10</td>
<td>5.79</td>
<td>0.39</td>
<td>(2.81)</td>
</tr>
<tr>
<td></td>
<td>(7.84)</td>
<td>(26.96)</td>
<td>(0.88)</td>
<td>(12.10)</td>
<td>(28.59)</td>
<td>(8.78)</td>
<td>(15.94)</td>
<td>(26.69)</td>
<td>(11.09)</td>
<td>(32.47)</td>
<td>(10.64)</td>
<td>(8.92)</td>
<td>(20.43)</td>
</tr>
<tr>
<td>C5</td>
<td>6.60</td>
<td>1.49</td>
<td>46.17</td>
<td>7.15</td>
<td>6.24</td>
<td>13.40</td>
<td>12.03</td>
<td>14.83</td>
<td>7.95</td>
<td>4.08</td>
<td>7.36</td>
<td>10.22</td>
<td>9.62</td>
</tr>
<tr>
<td>CT</td>
<td>25.52</td>
<td>9.20</td>
<td>61.19</td>
<td>27.43</td>
<td>27.88</td>
<td>39.51</td>
<td>24.82</td>
<td>27.06</td>
<td>27.95</td>
<td>37.32</td>
<td>48.64</td>
<td>44.84</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>0.19</td>
<td>0.12</td>
<td>0.07</td>
<td>0.31</td>
<td>0.13</td>
<td>0.32</td>
<td>0.30</td>
<td>0.08</td>
<td>0.10</td>
<td>0.82</td>
<td>0.051</td>
<td>(1.38)</td>
<td>(0.12)</td>
</tr>
<tr>
<td></td>
<td>(0.57)</td>
<td>(0.36)</td>
<td>(0.83)</td>
<td>(0.83)</td>
<td>(0.83)</td>
<td>(0.83)</td>
<td>(0.83)</td>
<td>(0.83)</td>
<td>(0.83)</td>
<td>(0.83)</td>
<td>(0.83)</td>
<td>(0.83)</td>
<td>(0.83)</td>
</tr>
<tr>
<td>C3</td>
<td>7.10</td>
<td>6.50</td>
<td>9.18</td>
<td>20.16</td>
<td>21.82</td>
<td>12.29</td>
<td>19.87</td>
<td>6.92</td>
<td>20.27</td>
<td>26.82</td>
<td>26.02</td>
<td>(51.60)</td>
<td>(58.95)</td>
</tr>
<tr>
<td></td>
<td>(31.04)</td>
<td>(29.28)</td>
<td>(53.90)</td>
<td>(57.26)</td>
<td>(41.10)</td>
<td>(44.43)</td>
<td>(63.40)</td>
<td>(41.10)</td>
<td>(41.10)</td>
<td>(41.10)</td>
<td>(41.10)</td>
<td>(41.10)</td>
<td>(41.10)</td>
</tr>
<tr>
<td>Low</td>
<td>C4</td>
<td>2.39</td>
<td>1.01</td>
<td>1.17</td>
<td>1.27</td>
<td>13.08</td>
<td>1.59</td>
<td>7.66</td>
<td>0.89</td>
<td>0.99</td>
<td>1.03</td>
<td>1.50</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td>(21.08)</td>
<td>(4.82)</td>
<td>(5.01)</td>
<td>(3.40)</td>
<td>(3.40)</td>
<td>(3.40)</td>
<td>(3.40)</td>
<td>(3.40)</td>
<td>(3.40)</td>
<td>(3.40)</td>
<td>(3.40)</td>
<td>(3.40)</td>
<td>(3.40)</td>
</tr>
<tr>
<td>C5</td>
<td>2.10</td>
<td>3.02</td>
<td>2.48</td>
<td>3.14</td>
<td>5.29</td>
<td>3.14</td>
<td>22.77</td>
<td>5.55</td>
<td>2.04</td>
<td>7.07</td>
<td>4.21</td>
<td>5.67</td>
<td>(12.85)</td>
</tr>
<tr>
<td>CT</td>
<td>13.76</td>
<td>20.94</td>
<td>23.37</td>
<td>37.40</td>
<td>24.59</td>
<td>38.11</td>
<td>60.43</td>
<td>27.66</td>
<td>31.34</td>
<td>29.83</td>
<td>31.29</td>
<td>42.09</td>
<td>44.14</td>
</tr>
</tbody>
</table>
Table 3.8: Concentrations of Individual Components from SFP for Contour 3 of the Lake

<table>
<thead>
<tr>
<th>Sites</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan2k</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0.24</td>
<td>0.33</td>
<td>0.38</td>
<td>0.26</td>
<td>0.03</td>
<td>0.54</td>
<td>0.34</td>
<td>0.50</td>
<td>0.01</td>
<td>0.15</td>
<td>1.44</td>
<td>0.97</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>(1.06)</td>
<td>(1.51)</td>
<td>(1.23)</td>
<td>(0.93)</td>
<td>(0.11)</td>
<td>(2.21)</td>
<td>(0.53)</td>
<td>(2.50)</td>
<td>(0.03)</td>
<td>(0.60)</td>
<td>(2.14)</td>
<td>(1.01)</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>8.18</td>
<td>11.04</td>
<td>15.28</td>
<td>10.49</td>
<td>0.95</td>
<td>12.96</td>
<td>2.60</td>
<td>8.26</td>
<td>5.10</td>
<td>7.16</td>
<td>38.09</td>
<td>28.84</td>
<td>25.99</td>
</tr>
<tr>
<td></td>
<td>(36.08)</td>
<td>(50.41)</td>
<td>(49.35)</td>
<td>(37.34)</td>
<td>(3.35)</td>
<td>(53.07)</td>
<td>(4.08)</td>
<td>(41.36)</td>
<td>(16.79)</td>
<td>(28.74)</td>
<td>(68.37)</td>
<td>(63.51)</td>
<td>(55.98)</td>
</tr>
<tr>
<td>C3</td>
<td>0.91</td>
<td>0.22</td>
<td>1.19</td>
<td>0.88</td>
<td>1.18</td>
<td>2.20</td>
<td>0.75</td>
<td>7.61</td>
<td>0.73</td>
<td>1.41</td>
<td>1.51</td>
<td>1.64</td>
<td>(3.33)</td>
</tr>
<tr>
<td></td>
<td>(4.01)</td>
<td>(1.00)</td>
<td>(3.84)</td>
<td>(3.13)</td>
<td>(4.83)</td>
<td>(3.80)</td>
<td>(3.76)</td>
<td>(2.93)</td>
<td>(2.53)</td>
<td>(3.33)</td>
<td>(3.33)</td>
<td>(3.33)</td>
<td></td>
</tr>
<tr>
<td>Sur</td>
<td>C4</td>
<td>3.22</td>
<td>3.41</td>
<td>2.93</td>
<td>3.45</td>
<td>3.68</td>
<td>3.41</td>
<td>9.40</td>
<td>2.94</td>
<td>0.07</td>
<td>7.52</td>
<td>4.36</td>
<td>8.66</td>
</tr>
<tr>
<td></td>
<td>(14.64)</td>
<td>(15.57)</td>
<td>(9.46)</td>
<td>(12.28)</td>
<td>(13.96)</td>
<td>(12.98)</td>
<td>(13.96)</td>
<td>(14.73)</td>
<td>(14.72)</td>
<td>(0.23)</td>
<td>(30.19)</td>
<td>(7.83)</td>
<td>(9.09)</td>
</tr>
<tr>
<td>C5</td>
<td>10.02</td>
<td>6.91</td>
<td>11.18</td>
<td>13.01</td>
<td>5.71</td>
<td>6.33</td>
<td>29.30</td>
<td>7.49</td>
<td>17.57</td>
<td>9.36</td>
<td>16.44</td>
<td>9.97</td>
<td>10.07</td>
</tr>
<tr>
<td></td>
<td>(44.20)</td>
<td>(31.55)</td>
<td>(36.11)</td>
<td>(46.32)</td>
<td>(20.14)</td>
<td>(25.92)</td>
<td>(45.92)</td>
<td>(37.51)</td>
<td>(57.85)</td>
<td>(37.59)</td>
<td>(18.74)</td>
<td>(21.90)</td>
<td>(21.69)</td>
</tr>
<tr>
<td>CT</td>
<td>26.67</td>
<td>21.90</td>
<td>30.96</td>
<td>28.09</td>
<td>28.35</td>
<td>24.42</td>
<td>63.80</td>
<td>19.97</td>
<td>30.37</td>
<td>24.91</td>
<td>55.71</td>
<td>45.41</td>
<td>46.43</td>
</tr>
<tr>
<td>Mid</td>
<td>C1</td>
<td>0.20</td>
<td>0.13</td>
<td>0.33</td>
<td>0.26</td>
<td>0.50</td>
<td>0.66</td>
<td>0.38</td>
<td>0.10</td>
<td>0.53</td>
<td>0.80</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.83)</td>
<td>(0.55)</td>
<td>(1.06)</td>
<td>(0.84)</td>
<td>(1.88)</td>
<td>(1.63)</td>
<td>(1.68)</td>
<td>(0.04)</td>
<td>(1.63)</td>
<td>(1.63)</td>
<td>(1.63)</td>
<td>(0.57)</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>9.61</td>
<td>7.28</td>
<td>15.75</td>
<td>17.65</td>
<td>0.76</td>
<td>22.43</td>
<td>11.64</td>
<td>5.21</td>
<td>13.28</td>
<td>17.25</td>
<td>30.94</td>
<td>29.88</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(40.96)</td>
<td>(30.52)</td>
<td>(50.74)</td>
<td>(57.18)</td>
<td>(2.86)</td>
<td>(54.34)</td>
<td>(51.57)</td>
<td>(18.93)</td>
<td>(43.50)</td>
<td>(52.98)</td>
<td>(64.67)</td>
<td>(63.60)</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>0.94</td>
<td>1.08</td>
<td>1.15</td>
<td>1.06</td>
<td>1.78</td>
<td>1.43</td>
<td>0.54</td>
<td>0.80</td>
<td>0.97</td>
<td>0.93</td>
<td>1.60</td>
<td>1.75</td>
<td>(3.72)</td>
</tr>
<tr>
<td></td>
<td>(4.01)</td>
<td>(4.53)</td>
<td>(3.70)</td>
<td>(4.33)</td>
<td>(6.70)</td>
<td>(3.53)</td>
<td>(2.39)</td>
<td>(2.62)</td>
<td>(2.98)</td>
<td>(2.17)</td>
<td>(3.34)</td>
<td>(3.72)</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>C4</td>
<td>3.68</td>
<td>4.23</td>
<td>3.41</td>
<td>3.59</td>
<td>2.95</td>
<td>3.47</td>
<td>3.08</td>
<td>4.73</td>
<td>4.60</td>
<td>4.31</td>
<td>25.22</td>
<td>4.53</td>
</tr>
<tr>
<td>C5</td>
<td>9.02</td>
<td>11.12</td>
<td>10.40</td>
<td>8.31</td>
<td>12.54</td>
<td>6.93</td>
<td>16.73</td>
<td>11.75</td>
<td>9.50</td>
<td>12.48</td>
<td>10.28</td>
<td>10.55</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(38.45)</td>
<td>(46.62)</td>
<td>(33.51)</td>
<td>(26.92)</td>
<td>(30.94)</td>
<td>(30.70)</td>
<td>(60.79)</td>
<td>(38.49)</td>
<td>(29.18)</td>
<td>(29.09)</td>
<td>(21.49)</td>
<td>(22.46)</td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td>23.46</td>
<td>23.85</td>
<td>31.04</td>
<td>30.87</td>
<td>26.57</td>
<td>40.53</td>
<td>22.57</td>
<td>27.52</td>
<td>30.53</td>
<td>32.56</td>
<td>42.90</td>
<td>47.84</td>
<td>46.98</td>
</tr>
</tbody>
</table>

C1 | 0.03 (0.01) | 0.09 (0.04) | 0.05 (0.02) | 0.29 (0.10) | 0.08 (0.25) | 0.37 (0.95) | 0.16 (0.78) | 0.79 (2.89) | 0.03 (0.08) | 0.24 (1.04) | 0.53 (1.53) | 0.06 (2.21) |
<p>| C2 | 3.45 (11.79) | 6.74 (33.78) | 5.05 (16.15) | 11.39 (44.72) | 4.30 (13.56) | 22.26 (57.43) | 2.54 (12.35) | 11.85 (43.37) | 3.18 (3.10) | 0.69 (3.00) | 22.17 (64.21) | 7.28 (56.09) |
| C3 | 1.50 (5.12) | 0.98 (17.44) | 1.85 (5.92) | 1.41 (5.54) | 11.91 (37.57) | 1.53 (3.95) | 0.60 (2.92) | 0.89 (3.26) | 1.06 (2.79) | 7.89 (34.35) | 1.20 (3.48) | 1.37 (4.83) |
| C4 | 0.51 (1.74) | 3.15 (15.79) | 0.90 (2.88) | 2.48 (9.74) | 7.48 (23.60) | 3.07 (7.92) | 8.23 (40.03) | 2.42 (8.86) | 21.26 (55.77) | 7.96 (34.65) | 3.65 (10.57) | 24.80 (58.00) |
| C5 | 23.82 (81.38) | 8.99 (45.06) | 23.46 (75.05) | 9.92 (38.95) | 7.93 (25.02) | 11.54 (43.87) | 9.02 (41.58) | 11.36 (38.23) | 6.20 (26.99) | 6.98 (26.99) | 9.23 (21.59) | 19.67 (33.45) |
| CT | 29.27 (19.95) | 31.26 (25.47) | 31.70 (28.76) | 20.56 (27.32) | 38.01 (34.53) | 22.97 (42.76) | 34.53 (58.80) |       |       |       |       |       |</p>
<table>
<thead>
<tr>
<th>Sites</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan 2K</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0.06</td>
<td>0.31</td>
<td>0.37</td>
<td>0.23</td>
<td>0.10</td>
<td>0.28</td>
<td>0.28</td>
<td>0.23</td>
<td>0.28</td>
<td>0.62</td>
<td>0.55</td>
<td>0.56</td>
<td>0.003</td>
</tr>
<tr>
<td>C2</td>
<td>4.20 (48.28)</td>
<td>7.19 (39.55)</td>
<td>16.66 (49.51)</td>
<td>17.31 (50.39)</td>
<td>6.75 (18.35)</td>
<td>13.61 (53.41)</td>
<td>8.89 (34.70)</td>
<td>9.67 (37.89)</td>
<td>21.75 (62.63)</td>
<td>13.73 (30.48)</td>
<td>25.48 (65.07)</td>
<td>31.12 (63.93)</td>
<td>29.29 (47.60)</td>
</tr>
<tr>
<td>C3</td>
<td>3.0 (34.48)</td>
<td>0.88 (3.48)</td>
<td>1.17 (3.48)</td>
<td>1.26 (3.67)</td>
<td>9.86 (26.80)</td>
<td>1.24 (4.87)</td>
<td>0.59 (2.30)</td>
<td>0.87 (3.41)</td>
<td>1.04 (2.99)</td>
<td>0.54 (1.20)</td>
<td>1.29 (3.29)</td>
<td>1.51 (3.94)</td>
<td>8.44 (13.54)</td>
</tr>
<tr>
<td>C4</td>
<td>0.80 (9.20)</td>
<td>2.85 (15.68)</td>
<td>3.88 (10.94)</td>
<td>3.88 (11.30)</td>
<td>9.35 (25.41)</td>
<td>3.23 (12.68)</td>
<td>4.94 (19.28)</td>
<td>4.68 (18.34)</td>
<td>2.58 (7.43)</td>
<td>4.57 (10.15)</td>
<td>4.30 (10.98)</td>
<td>6.95 (13.41)</td>
<td>5.31 (8.52)</td>
</tr>
<tr>
<td>C5</td>
<td>0.70 (8.60)</td>
<td>6.95 (38.23)</td>
<td>11.78 (35.01)</td>
<td>11.67 (33.97)</td>
<td>10.72 (29.14)</td>
<td>6.62 (25.98)</td>
<td>11.01 (42.97)</td>
<td>10.01 (39.22)</td>
<td>8.73 (25.14)</td>
<td>10.19 (35.62)</td>
<td>7.50 (19.15)</td>
<td>9.68 (18.68)</td>
<td>24.59 (39.46)</td>
</tr>
<tr>
<td>CT</td>
<td>8.70 (18.18)</td>
<td>18.18 (33.65)</td>
<td>34.35 (34.35)</td>
<td>36.79 (25.48)</td>
<td>25.62 (25.52)</td>
<td>34.73 (45.04)</td>
<td>45.04 (39.16)</td>
<td>51.81 (62.32)</td>
<td>51.81 (62.32)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>0.73 (2.03)</td>
<td>0.69 (0.41)</td>
<td>0.87 (2.56)</td>
<td>0.75 (0.76)</td>
<td>0.73 (1.85)</td>
<td>0.10 (0.54)</td>
<td>0.49 (1.80)</td>
<td>0.64 (1.32)</td>
<td>0.64 (1.32)</td>
<td>0.76 (1.98)</td>
<td>1.16 (2.37)</td>
<td>1.66 (4.16)</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>19.59 (56.15)</td>
<td>7.44 (33.90)</td>
<td>19.88 (58.51)</td>
<td>15.85 (50.37)</td>
<td>5.04 (14.61)</td>
<td>22.49 (56.97)</td>
<td>5.24 (28.54)</td>
<td>11.93 (45.78)</td>
<td>19.03 (56.87)</td>
<td>14.97 (51.36)</td>
<td>25.31 (65.77)</td>
<td>31.33 (63.98)</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>1.00 (2.87)</td>
<td>1.00 (4.56)</td>
<td>1.21 (5.36)</td>
<td>1.24 (3.94)</td>
<td>11.42 (33.29)</td>
<td>1.40 (3.55)</td>
<td>2.08 (8.13)</td>
<td>0.86 (3.30)</td>
<td>0.97 (3.29)</td>
<td>0.86 (3.29)</td>
<td>1.29 (3.35)</td>
<td>1.68 (11.26)</td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>2.91 (8.34)</td>
<td>3.36 (15.31)</td>
<td>2.15 (6.33)</td>
<td>3.72 (11.82)</td>
<td>8.35 (24.34)</td>
<td>2.60 (6.59)</td>
<td>8.13 (44.28)</td>
<td>3.52 (13.51)</td>
<td>3.02 (9.03)</td>
<td>4.83 (16.57)</td>
<td>3.94 (10.24)</td>
<td>3.96 (8.09)</td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td>10.69 (30.64)</td>
<td>10.06 (45.83)</td>
<td>9.87 (29.05)</td>
<td>10.42 (33.11)</td>
<td>9.43 (27.49)</td>
<td>12.25 (31.03)</td>
<td>9.82 (35.53)</td>
<td>10.00 (29.89)</td>
<td>7.85 (26.93)</td>
<td>7.18 (18.66)</td>
<td>10.85 (22.16)</td>
<td>25.24 (40.59)</td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td>34.89 (21.95)</td>
<td>33.98 (31.47)</td>
<td>31.47 (34.30)</td>
<td>39.48 (38.46)</td>
<td>18.36 (26.06)</td>
<td>33.46 (29.15)</td>
<td>29.85 (48.97)</td>
<td>38.48 (62.18)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>0.11 (0.50)</td>
<td>0.16 (0.34)</td>
<td>0.51 (1.51)</td>
<td>0.34 (1.05)</td>
<td>0.08 (0.25)</td>
<td>0.88 (2.13)</td>
<td>0.39 (0.93)</td>
<td>0.85 (2.92)</td>
<td>0.37 (0.84)</td>
<td>0.27 (0.47)</td>
<td>0.58 (1.58)</td>
<td>0.60 (1.26)</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>3.53 (31.50)</td>
<td>11.59 (24.96)</td>
<td>15.63 (46.39)</td>
<td>17.00 (52.68)</td>
<td>4.30 (13.56)</td>
<td>24.12 (58.96)</td>
<td>6.42 (38.96)</td>
<td>16.08 (55.31)</td>
<td>19.87 (65.08)</td>
<td>13.32 (23.58)</td>
<td>23.75 (64.52)</td>
<td>32.67 (65.79)</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>2.22 (18.75)</td>
<td>0.75 (1.62)</td>
<td>1.30 (3.86)</td>
<td>1.52 (4.71)</td>
<td>11.91 (37.57)</td>
<td>1.54 (3.76)</td>
<td>0.72 (2.47)</td>
<td>0.87 (2.99)</td>
<td>1.06 (3.10)</td>
<td>3.12 (5.52)</td>
<td>1.33 (3.61)</td>
<td>1.67 (10.82)</td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>5.44 (45.95)</td>
<td>3.92 (8.44)</td>
<td>2.92 (8.67)</td>
<td>2.27 (7.03)</td>
<td>7.48 (23.60)</td>
<td>2.33 (5.70)</td>
<td>2.52 (15.29)</td>
<td>2.20 (7.67)</td>
<td>1.99 (7.92)</td>
<td>0.90 (1.59)</td>
<td>3.67 (9.69)</td>
<td>3.34 (10.5)</td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td>0.34 (2.87)</td>
<td>30.01 (64.63)</td>
<td>13.34 (39.60)</td>
<td>11.13 (34.49)</td>
<td>7.93 (25.02)</td>
<td>12.04 (29.43)</td>
<td>6.42 (38.96)</td>
<td>9.07 (31.20)</td>
<td>10.41 (30.43)</td>
<td>38.88 (68.83)</td>
<td>7.48 (20.32)</td>
<td>10.22 (23.53)</td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td>11.84 (46.43)</td>
<td>33.69 (32.27)</td>
<td>31.70 (30.91)</td>
<td>16.48 (29.07)</td>
<td>34.21 (56.49)</td>
<td>36.81 (43.43)</td>
<td>62.59 (10.26)</td>
<td>62.59 (10.26)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.9: Concentrations of Individual Components from SFP for Contour 4 of the Lake
SFP Analysis Based Plot of Individual Concentration of De-convoluted Components at Center of the Lake

Figure: 3.67 (a-f)
SFP Analysis Based Plot of Individual Concentration of De-convoluted Components at Contour 1 of the Lake

Figure: 3.68 (a-f)
SFP Analysis Based Plot of Individual Concentration of De-convoluted Components at Contour 2 of the Lake

(a) C1

(b) C2

(c) C3

(d) C4

(e) C5

(f) CT

Figure: 3.69 (a-f)
SFP Analysis Based Plot of Individual Concentration of De-convoluted Components at Contour 3 of the Lake

Figure: 3.70 (a-f)
SFP Analysis Based Plot of Individual Concentration of De-convoluted Components at Contour 4 of the Lake

Figure: 3.71 (a-f)