**4.5  CORRELATION  BETWEEN  PHYTOPLANKTON  AND PHYSIOCHEMICAL FACTORS**

**4.5.1 Nitrate**

Generally, phytoplankton number showed positive linear correlation with nitrate concentration. During high tide, both phytoplankton numbers at ST2 ($r$=0.852, $p$ <0.01) (Figure 4.50) and ST3 ($r$=0.776), $p$ <0.01) (Figure 4.50) were strongly correlated with nitrate concentration. Phytoplankton number also showed positive relation with nitrate concentration at ST1 ($r$=0.709) (Figure 4.52) and ST3 ($r$=0.637) (Figure 4.51) during low tide at sig. (*2 tailed*) $p$ < 0.05. However, though correlation at ST1 ($r$=0.456) during high tide and at ST2 ($r$=0.169) during low tide showed positive correlation, both were not proved to have significant correlation.

**4.5.2 Phosphate**

Phytoplankton numbers showed positive correlation to phosphate at all stations in both tides. However, only phytoplankton number at ST1 ($r$=0.892, $p$ <0.01) (Figure 4.54) and ST3 ($r$=0.600, $p$ <0.05) (Figure 4.55) during low tide were significantly correlated with phosphate concentration. Pearson's correlation displayed a quite high non significant positive correlation at ST2 ($r$=0.434) during low tide.
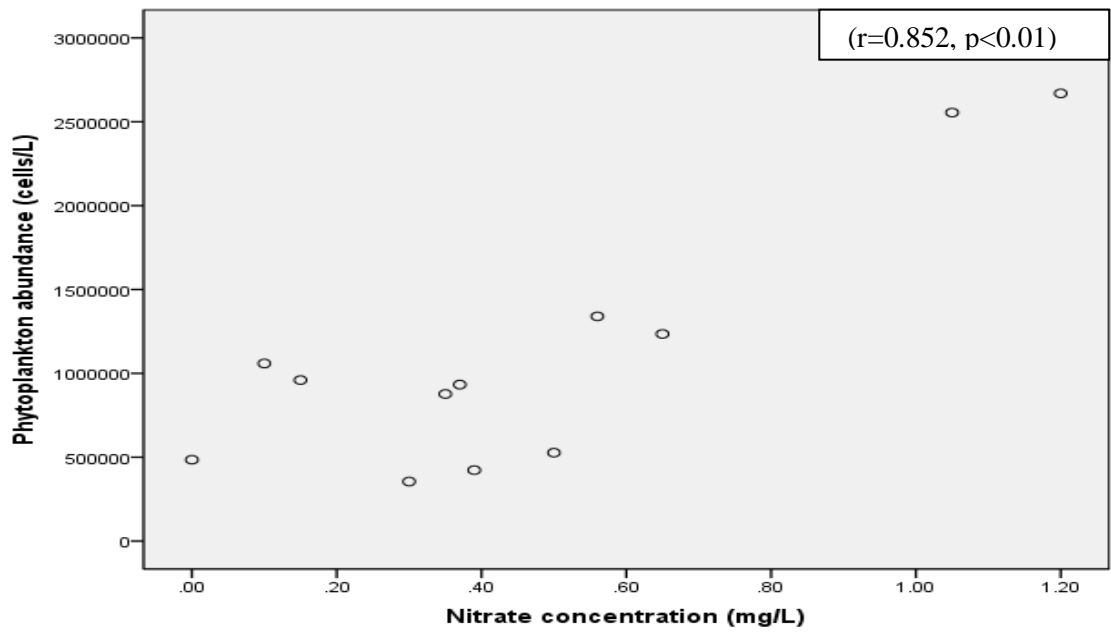
Figure 4.50: Correlation between phytoplankton number and nitrate concentration at
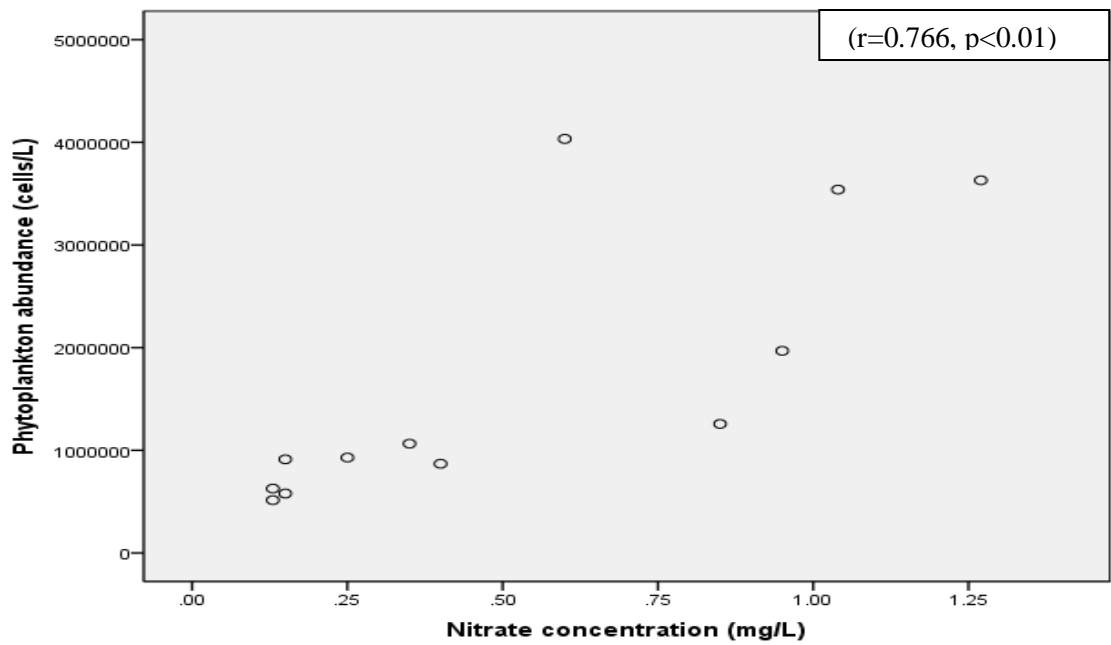
ST2 during high tide.



Figure 4.51: Scatter plot on correlation between phytoplankton number and nitrate

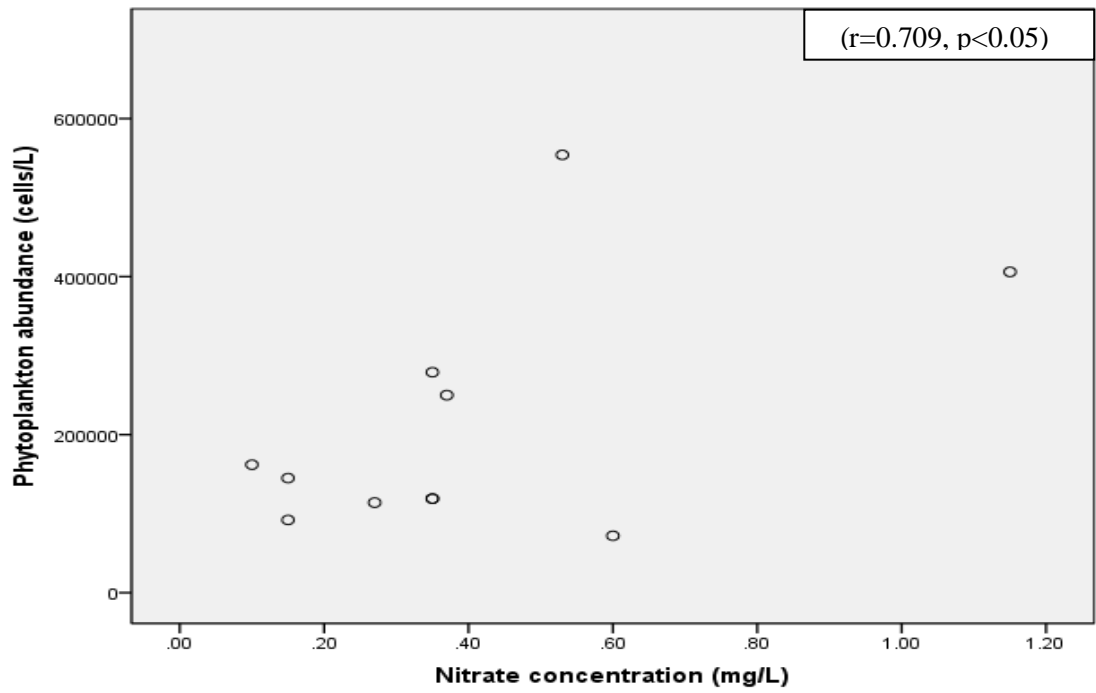concentration at ST3 during high tide.

Figure 4.52: Scatter plot on correlation of phytoplankton number and nitrate concentration at ST1 during low tide.
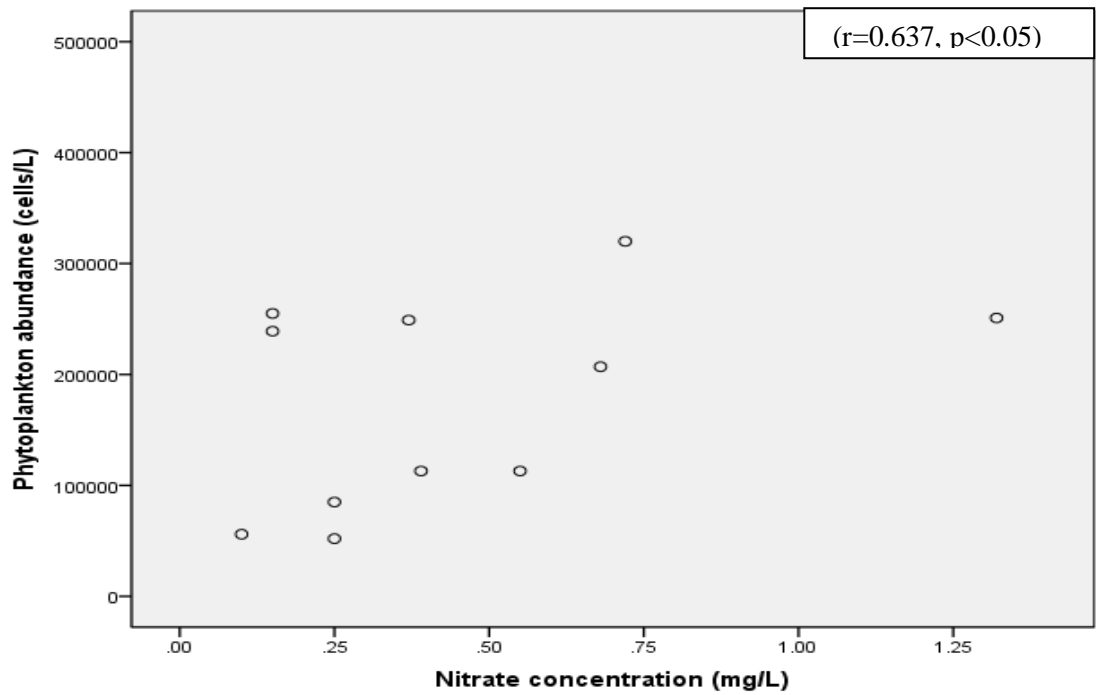


Figure 4.53: Scatter plot on correlation between phytoplankton number and nitrate concentration at ST3 during low tide.
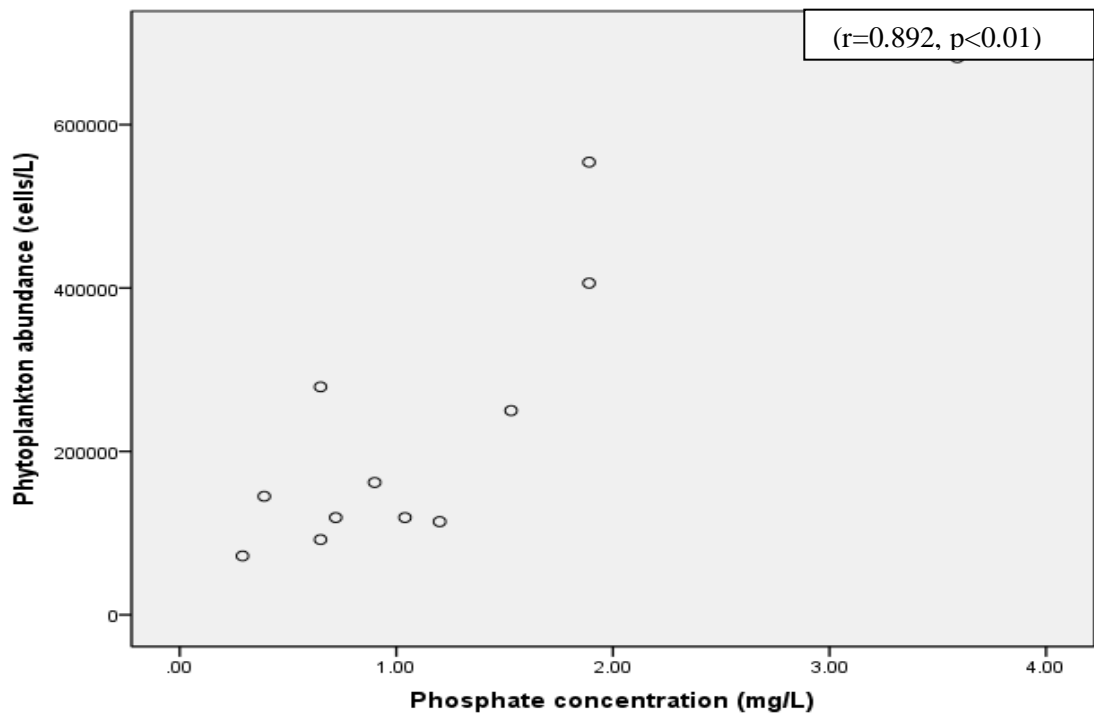
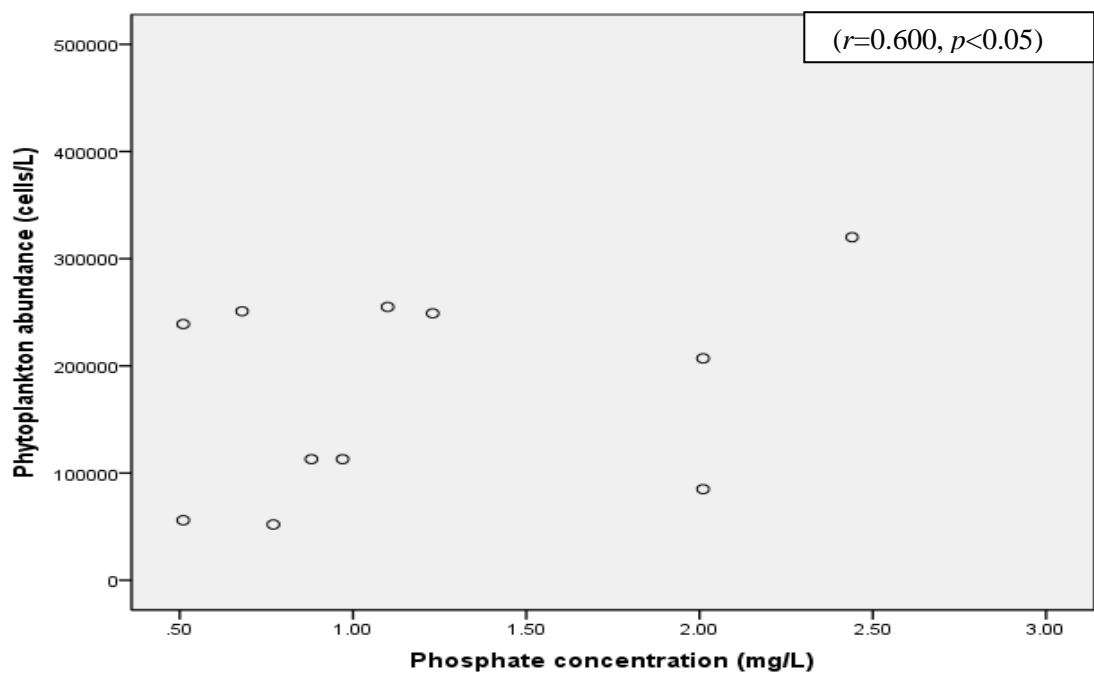Figure 4.54: Correlation between phytoplankton number and phosphate concentration at ST1 during low tide.



Figure 4.55: Correlation between phytoplankton number and phosphate concentration at ST3 during low tide.

### 4.5.3 Silica

The Pearson correlation displayed highly significant ($p$ <0.01) and positive correlation of the phytoplankton cell abundance with silicate concentration at ST1 ($r$=0.818) (Figure 4.56), ST2 ($r$=0.849) (Figure 4.57) and ST3 ($r$=0.816) (Figure 4.58) during high tide. Similarly, though the correlation did not prove a strong correlation, both phytoplankton number at ST1 ($r$=0.585) (Figure 4.59) and ST2 ($r$=0.670) (Figure 4.60) during low tide showed positive significant correlation to phosphate concentration at sig. (*2 tailed*) $p$ <0.05. However, a non significant linear correlation was showed at ST2 ($r$=0.394) during low tide.
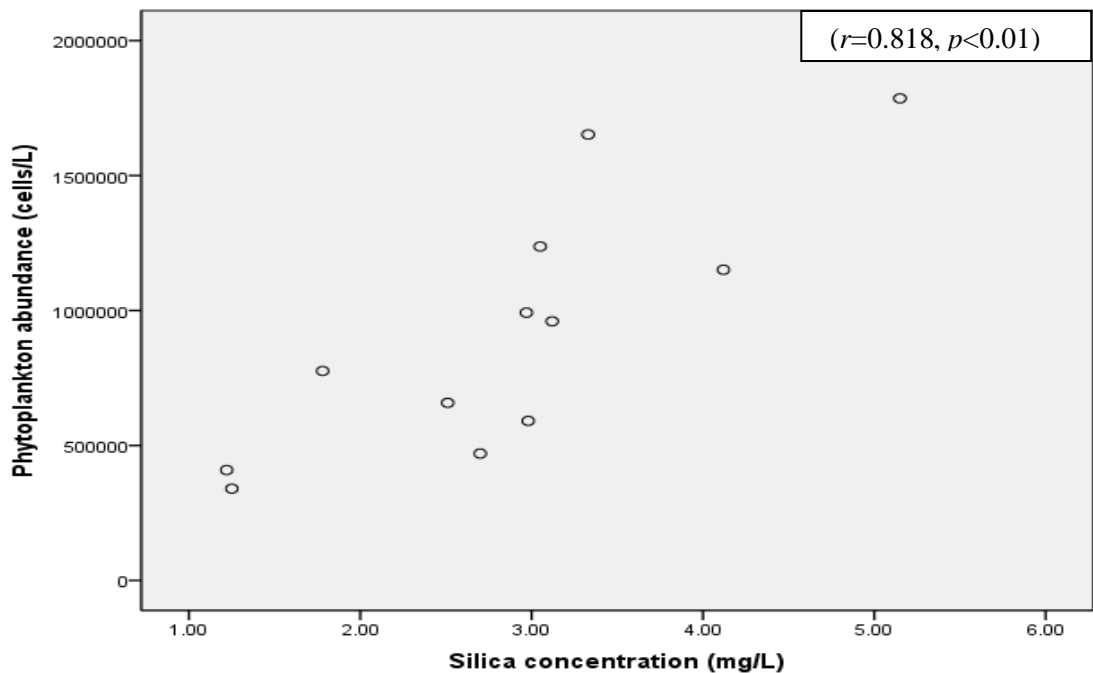


Figure 4.56: Correlation between phytoplankton abundance and silicate concentration at ST1 during high tide.
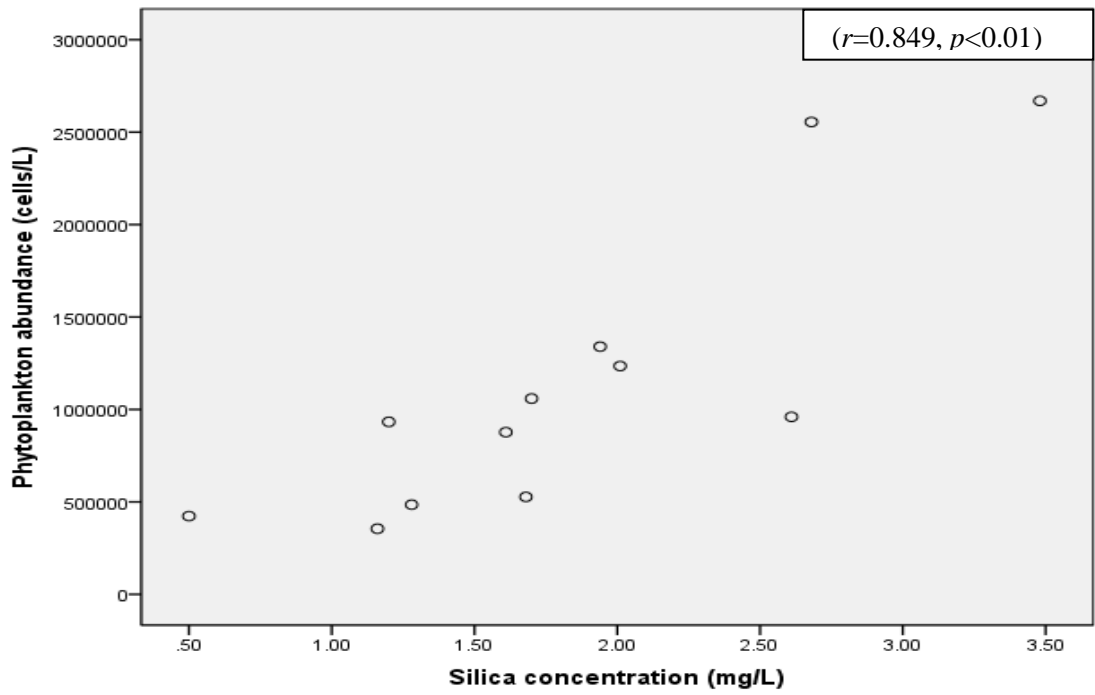
Figure 4.57: Correlation between phytoplankton abundance and silicate concentration at ST2 during high tide.
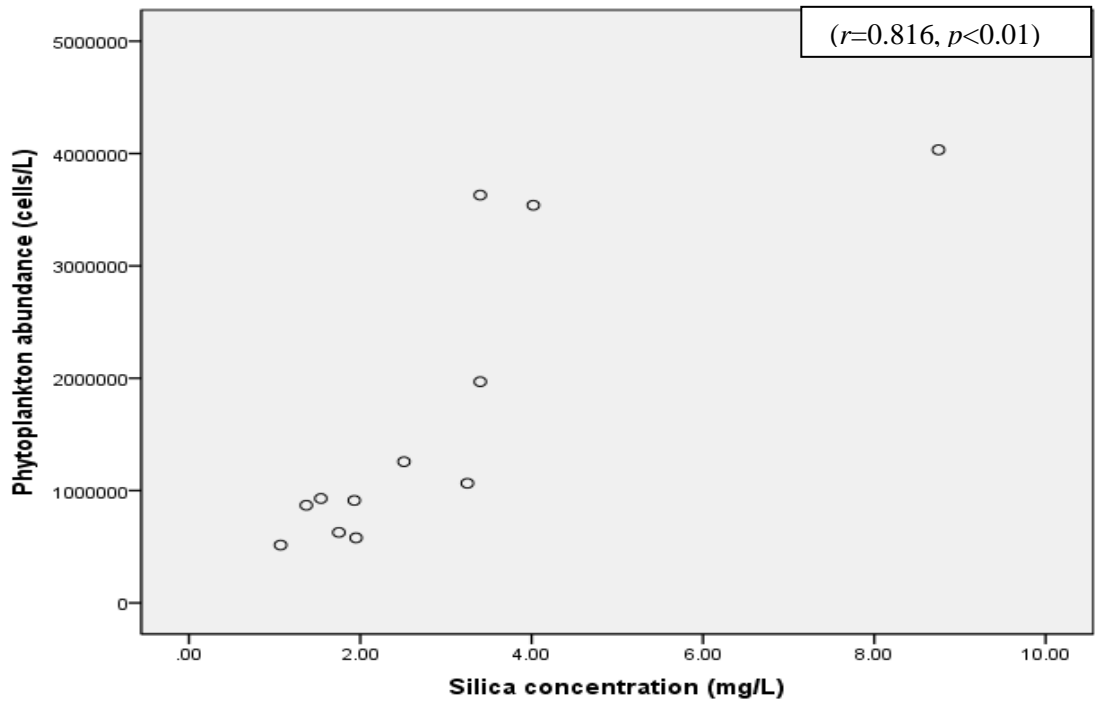


Figure 4.58: Correlation between phytoplankton abundance and silicate concentration at ST3 during high tide.
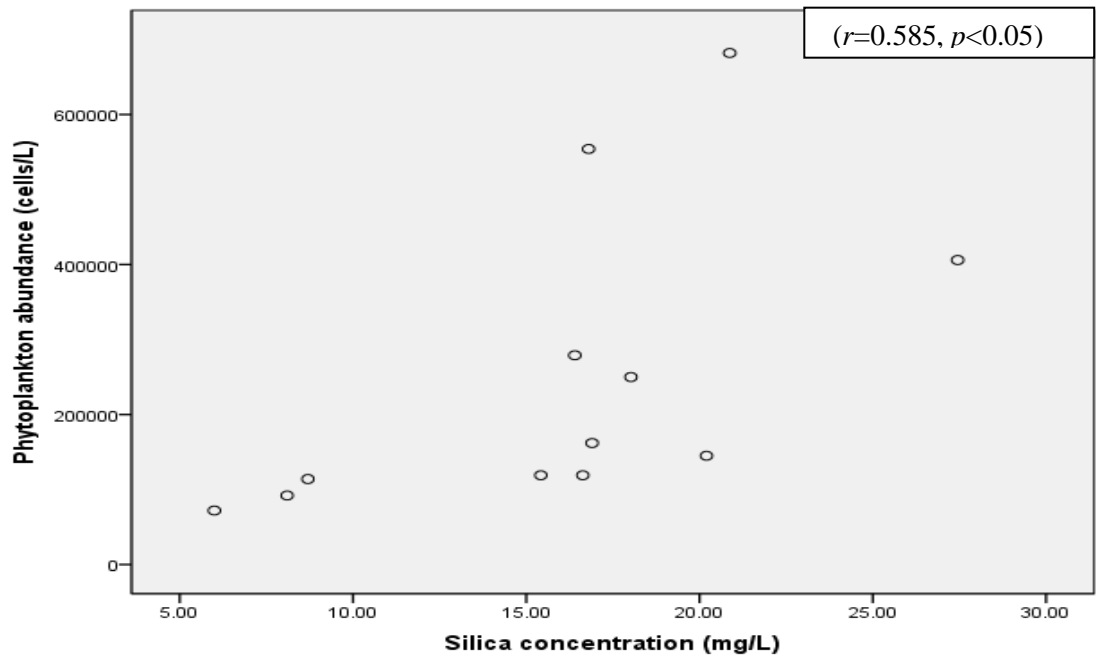
$(r=0.585, p<0.05)$

Figure 4.59: Correlation between phytoplankton abundance and silicate concentration at ST1 during low tide.
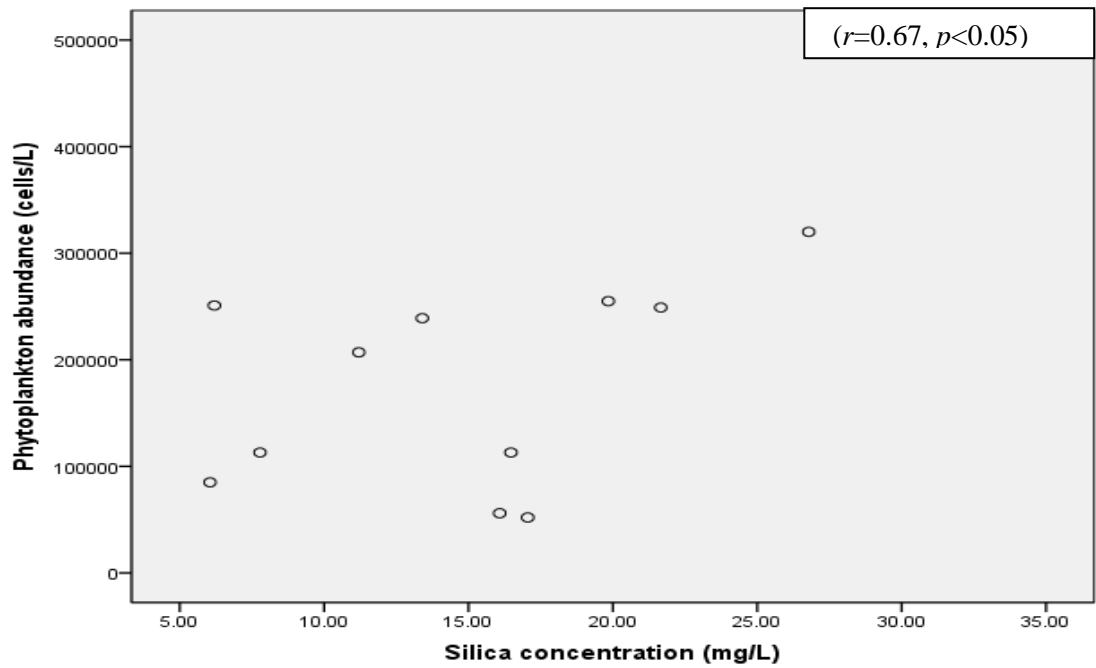


$(r=0.67, p<0.05)$

Figure 4.60: Correlation between phytoplankton abundance and silicate concentration at ST3 during low tide.

### 4.5.4 Sulfate

Generally, sulfate concentration influenced phytoplankton abundance in a way of positive correlation. However, 5 out of 6 sampling in both tides at 3 stations showed non- significant linear correlation between cells abundance and sulphate concentration when tested with Pearson correlation. Pearson correlation proved that there was a moderate positive linear correlation between phytoplankton abundance and nutrient concentration at ST1 during low tide ($r$=0.638, $p < 0.05$) (Figure 4.61). During high tide the value of Pearson correlation showed a non linear positive correlation with the value at ST1 ($r$=0.162), ST2 ($r$=0.061), ST3 ($r$=0.237) (Figure 4.62). While during low tide the value were ST2 ($r$=0.132) and ST3 ($r$=0.266).
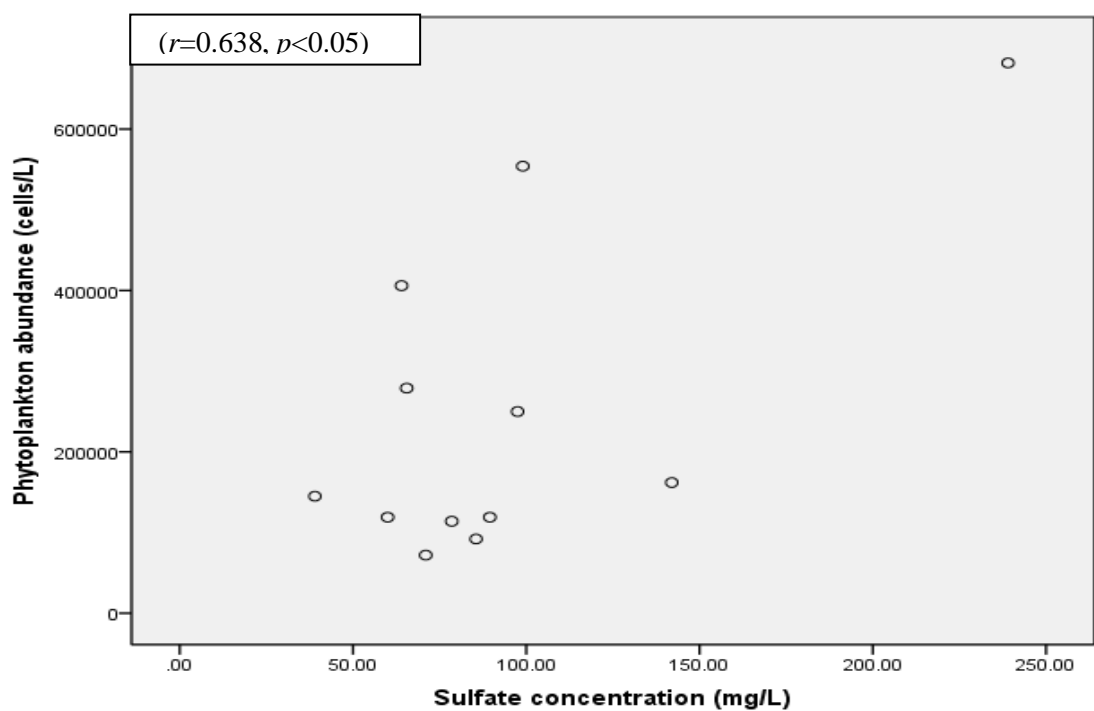


Figure 4.61: Correlation between phytoplankton abundance and sulfate concentration at ST1 during low tide.
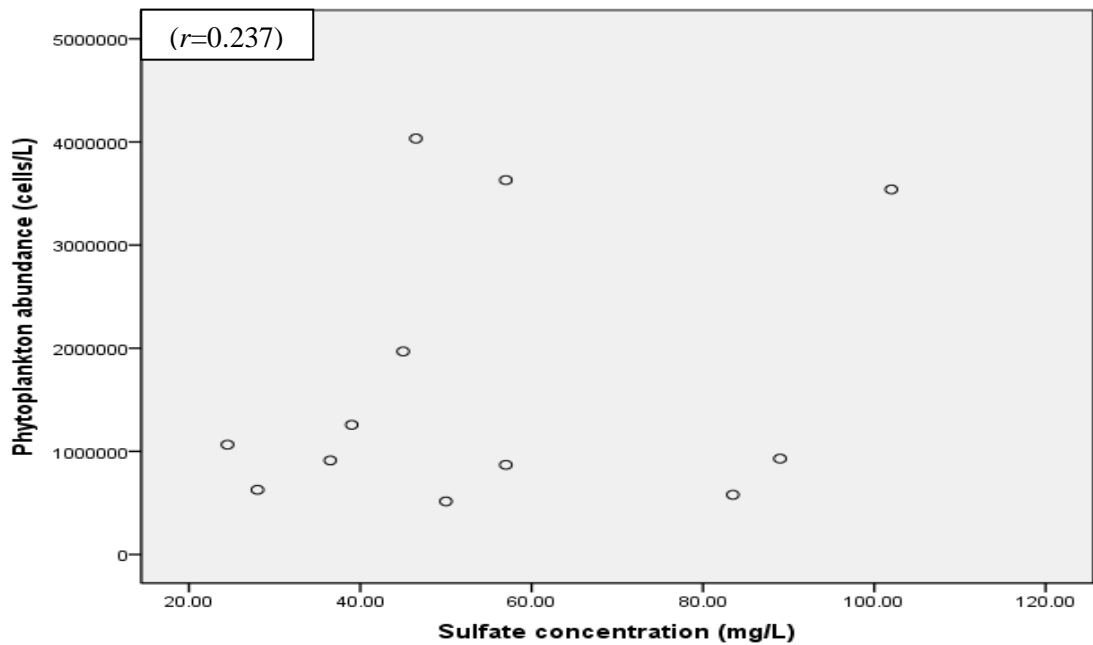
Figure 4.62: Non-linear positive correlation between phytoplankton abundance and sulfate concentration at ST3 during high tide.

### 4.5.5 Temperature

Pertaining to value of Pearson correlation, phytoplankton cell abundance was significantly correlated ($p$ <0.05) with temperature positively, during high tide at all stations. Phytoplankton abundance moderately correlated with temperature at ST1 ($r$=0.618, $p$ <0.05) (Figure 4.63), ST2 ($r$=0.600, $p$ <0.05) (Figure 4.64) and ST3 ($r$=0.609, $p$ <0.05) (Figure 4.65). However, phytoplankton abundance showed non-significant, low positive relationship to this physical parameter during low tide at ST2 ($r$=0.278) and ST3 ($r$=0.234). In contrast, during low tide at ST1 ($r$=0.593), there was a significant positive correlation between cell abundance and temperature at significant level $p$ <0.05 (Figure 4.66).
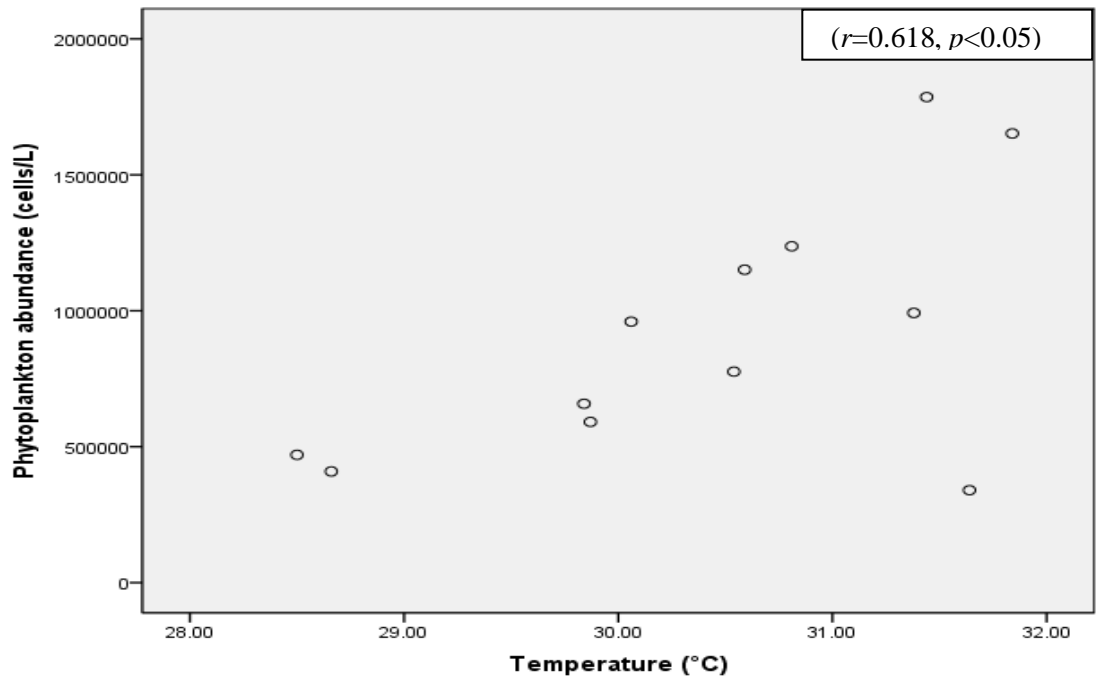
Figure 4.63: Correlation between phytoplankton abundance and temperature at ST1 during high tide.
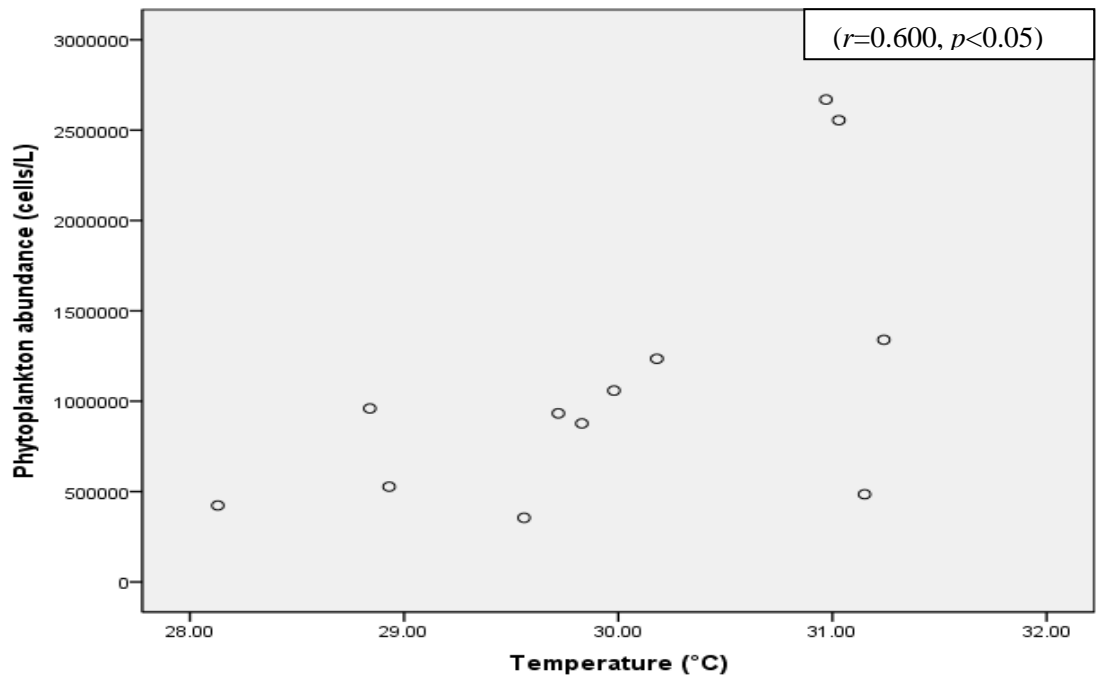


Figure 4.64: Correlation between phytoplankton abundance and temperature at ST2 during high tide.
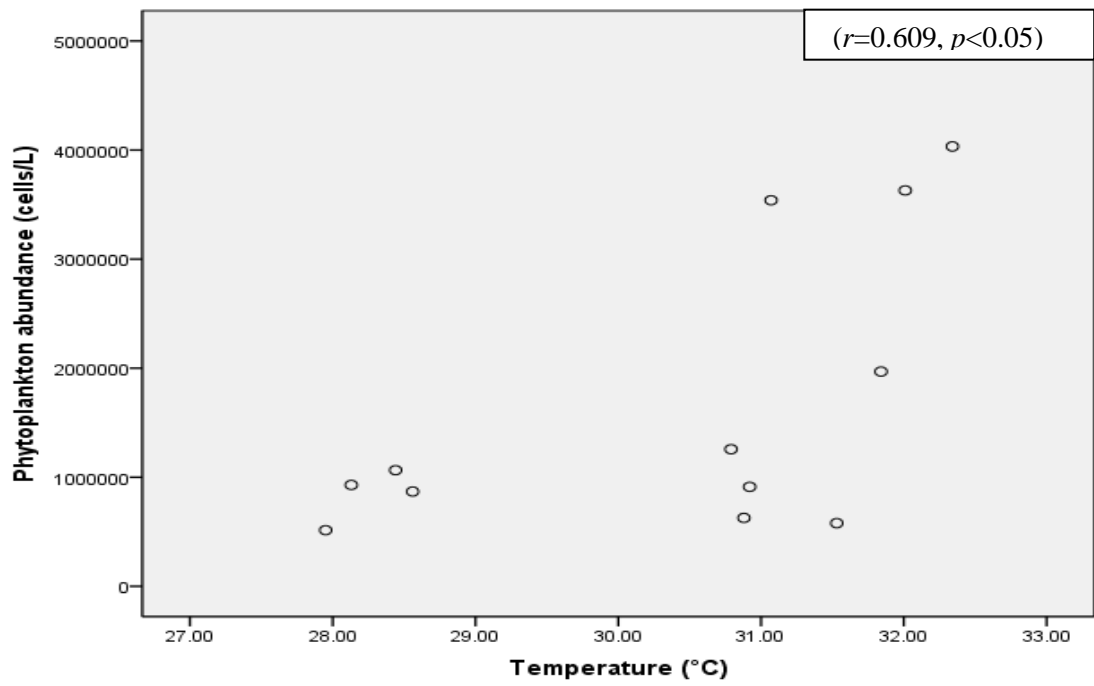
Figure 4.65: Correlation between phytoplankton abundance and temperature at ST3
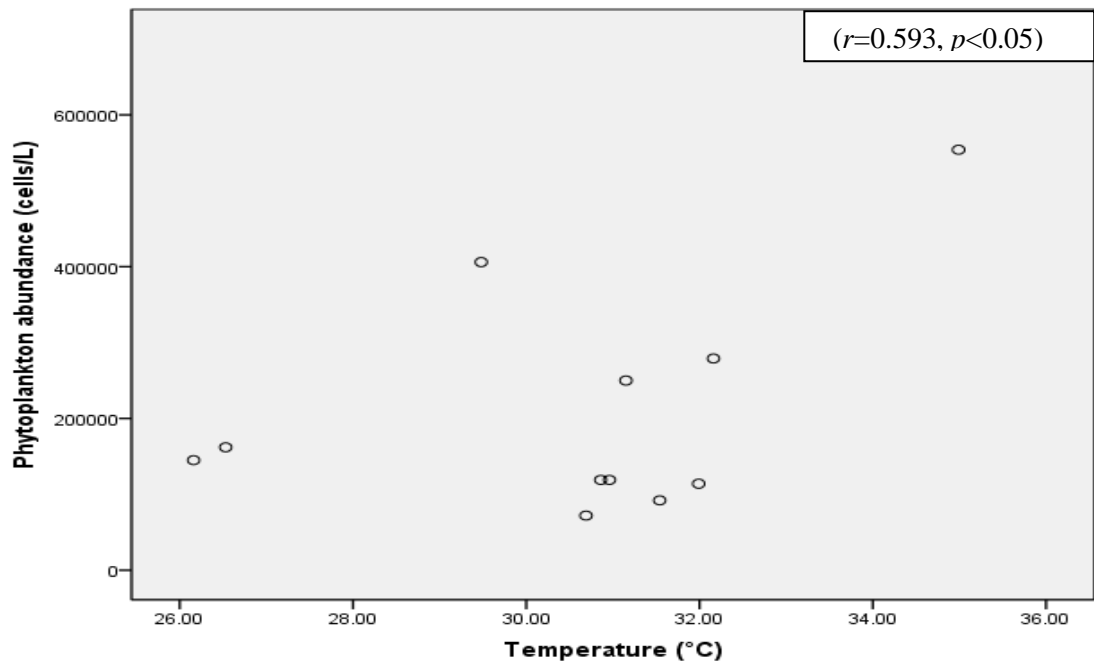during high tide.



Figure 4.66: Correlation between phytoplankton abundance and temperature at ST1
during low tide.

### 4.5.6 Conductivity

Phytoplankton abundance has a positive correlation with conductivity at research area. However, the values of Pearson correlation proved that all the correlation at all stations in both tides have low relationships to conductivity. The lowest correlation between cells abundance and conductivity were recorded at ST1 ($r$=0.144) during low tide. Phytoplankton proved to have a definite and small relationship to conductivity at ST1 ($r$=0.330) and ST3 ($r$=0.235) during high tide and at ST2 ($r$=0.333) and ST3 ($r$=0.300) during low tide. However, all relations were not a significant positive linear correlation.

### 4.5.7 Total Dissolved Solid

Phytoplankton showed negative correlations with total dissolved solid at all stations during high tide. In contrast, during low tide, Pearson correlation displayed low positive correlations of cells abundance and total dissolved solid. Total dissolved solid proved to have low influenced to phytoplankton abundance ST1 ($r$= -0.313) during high tide and at ST1 ($r$=0.205) and ST3 ($r$=0.365) during low tide. There were negligible relationships between phytoplankton abundance and parameter at ST1 ($r$= -0.015) and ST2 ($r$= -0.082) during high tide and at ST3 ($r$= 0.077) during low tide. However, all of the $r$ value at all stations in both tides were not significant at $p < 0.05$.

### 4.5.8 Salinity

The Pearson correlation displayed low and moderate non linear relationship between cells abundance and salinity at research area in both tides throughout a year. Phytoplankton abundance at ST3 ($r$=0.411) showed a substantial relationship to salinity during high tide. While during high tide at ST2 ($r$=0.237) and during low tide at ST2 ($r$=0.299) and ST3 ($r$=0.264), low and definite relationships were recorded between phytoplankton abundance and salinity.

### 4.5.9 Dissolved oxygen

Pertaining to Pearson correlation values, phytoplankton abundance were significantly ($p < 0.05$) correlated with dissolved oxygen in both tides. During high tide, there were substantial relationships between phytoplankton and dissolved oxygen at ST1 ($r = -0.682$, $p < 0.05$) (Figure 4.67), ST2 ($r = -0.632$, $p < 0.05$) (Figure 4.68) and ST3 ($r = -0.589$, $p < 0.05$) (Figure 4.69). Similarly in low tide, phytoplankton inversely correlated to dissolved oxygen at both ST1 ($r = -0.610$, $p < 0.05$) (Figure 4.70) and ST2 ($r = -0.604$, $p < 0.05$) (Figure 4.71). On the other hand, there was a non-linear positive relation between phytoplankton abundance and dissolved oxygen at ST3 ($r = 0.234$) during low tide.
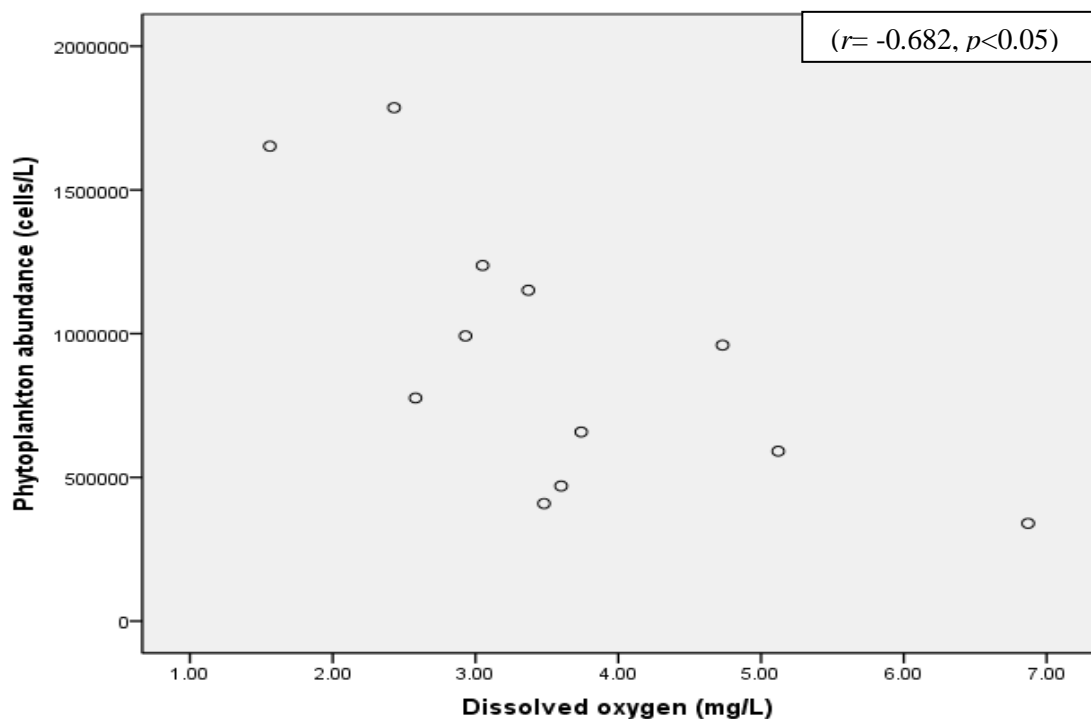


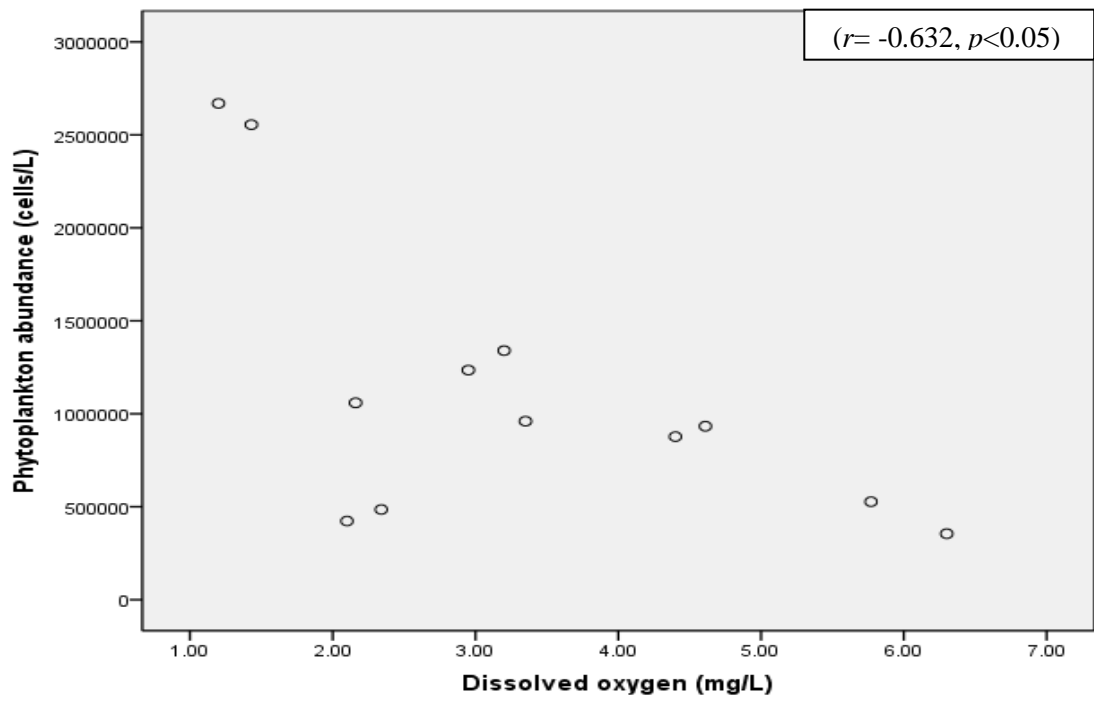Figure 4.67: Correlation between phytoplankton abundance and dissolved oxygen at ST1 during high tide.

Figure 4.68: Correlation between phytoplankton abundance and dissolved oxygen at
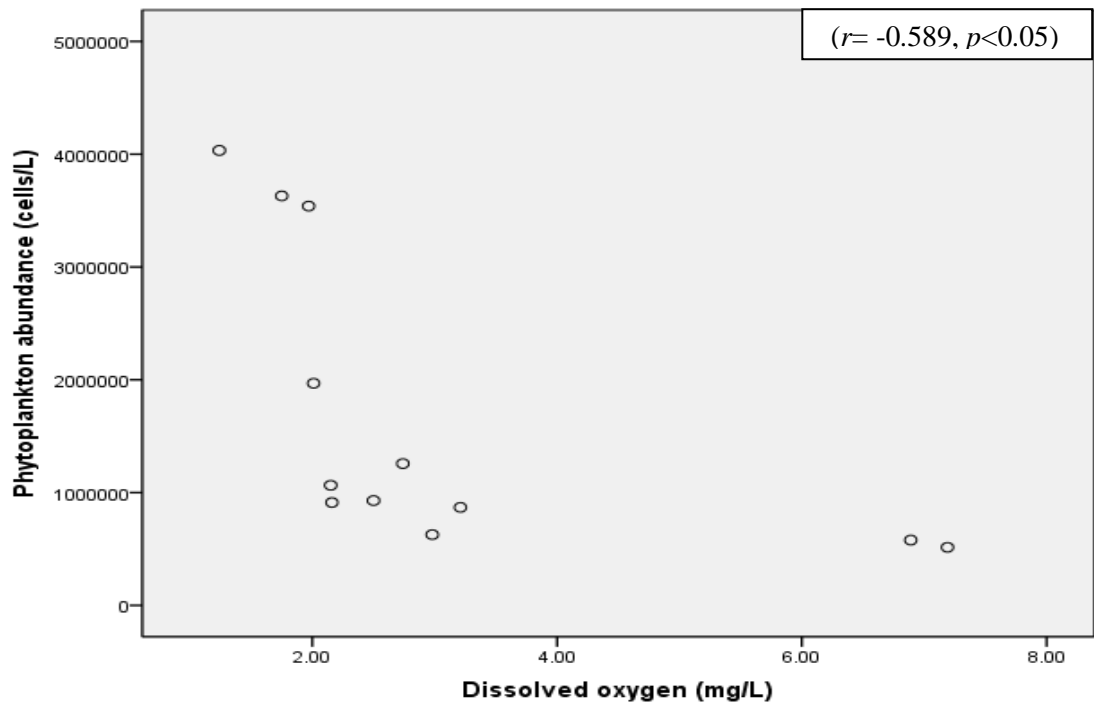ST2 during high tide.



Figure 4.69: Correlation between phytoplankton abundance and dissolved oxygen at
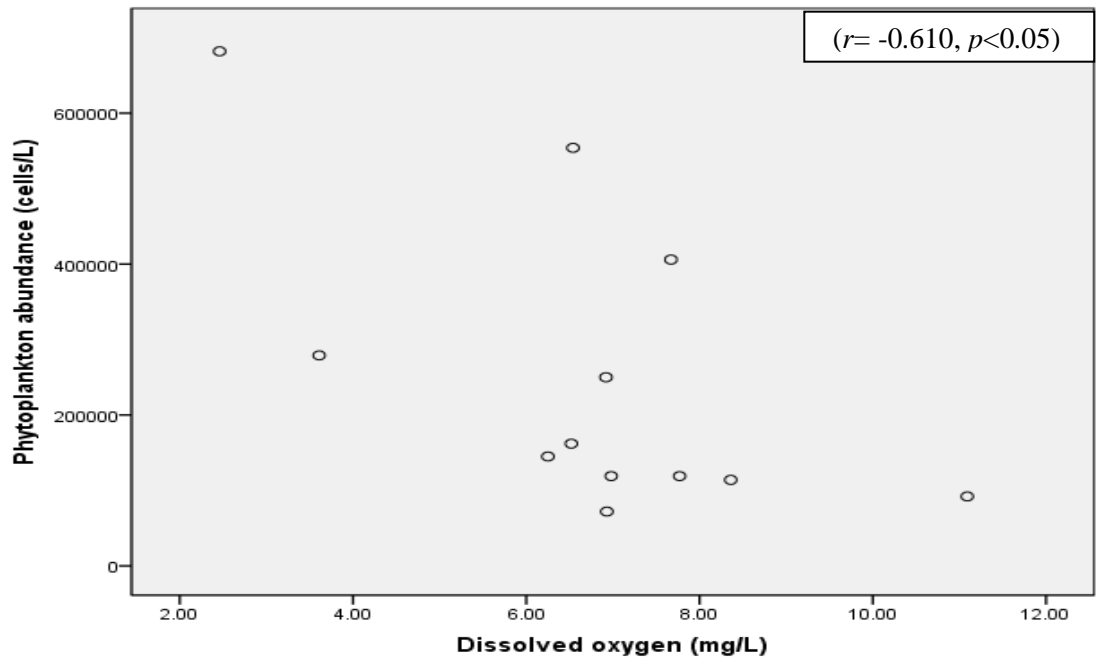ST3 during high tide.

Figure 4.70: Correlation between phytoplankton abundance and dissolved oxygen at
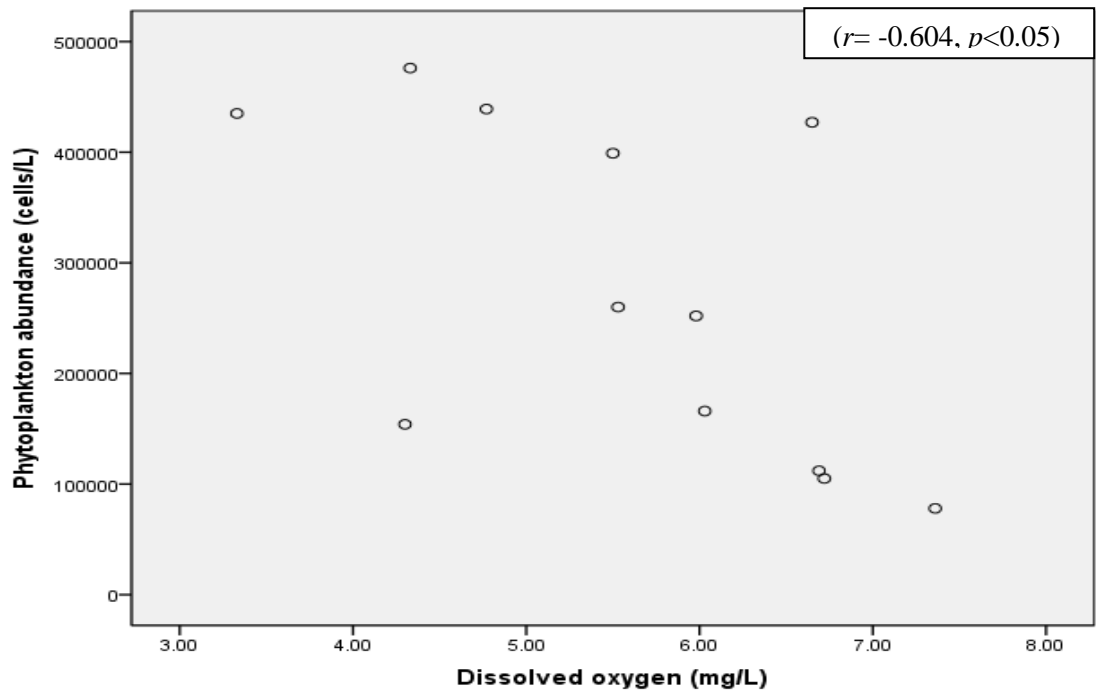ST1 during low tide.



Figure 4.71: Correlation between phytoplankton abundance and dissolved oxygen at
ST2 during low tide.

## 4.5.10 pH

Generally, phytoplankton abundance correlated positively with pH, though, at non-significant level in both tides at all stations. There was a moderate substantial relationship between phytoplankton and pH level at ST2 ($r$=0.480) during high tide. While at ST3 ($r$=0.339) during high tide and at ST1 ($r$=0.351) during low tide, there were definite and small relationships between phytoplankton and the parameter. Phytoplankton showed slight relations to parameter at ST1 ($r$=0.159) during high tide and at ST2 ($r$=0.115) and ST 3 ($r$=0.113) during low tide, which could be considered as negligible positive relations.