

## CHAPTER- VI

### Summary and Conclusion

Algae are invariably found in all fresh water bodies and are located at the base level of trophic structure. Their diversity, distribution and growth entirely dependent upon physical and chemical characteristics of water bodies. They were very sensitive to slightest changes in their habitat conditions. Hence, study on algal ecology may be used as a reliable tool to assess the pollution status of any aquatic system.

Since the first day of oil exploration, significant quantities of hydrocarbons and associated pollutants are being released in to the fresh water bodies of Upper Assam region in general and in the vicinity of Digboi oil field in particular. The algal members growing in those water bodies are regularly exposed to hydrocarbon pollutants. The present study was therefore, aimed to study the fresh water algal ecology in some selected ponds of Tinsukia district (Assam) in relation of crude oil contamination.

Five (5) water bodies of Tinsukia district were selected for the study which were designated as S1, S2, S3, S4 and S5. Of these five water bodies, S1 and S2 were located in Digboi oil field, S3 in Jorajan oil field, S4 within a paddy field at Pawoi and S5 inside Digboi township. Study was conducted for a period of two years from April, 2011 to March, 2013.

- ❖ A total of 317 algal species belonging to 108 genera representing 15 orders and 29 families were recorded under seven taxonomic classes: Cyanophyceae (23 genera, 69 species), Chlorophyceae (53 genera, 171 species) Bacillariophyceae (17 genera, 49 species), Euglenophyceae (6 genera, 16 species), Xanthophyceae (5 genera, 7 species), Chrysophyceae (4 genera, 5 species) and Dinophyceae (1 species) in the studied ponds of Tinsukia District.
- ❖ Chlorophyceae was the dominant group with 54% contribution which was followed by Cyanophyceae with 22%, Bacillariophyceae with 15%, Euglenophyceae with 5%, both Xanthophyceae and Chrysophyceae with 2 % each, while Dinophyceae had a negligible portion of 0.32%.
- ❖ Among Chlorophyceae, *Cosmarium* was the largest genus with 20 species, followed by *Scenedesmus* with 15 species and *Closterium* with 12 species.

*Oscillatoria* was the largest genus represented with 8 species among the group Cyanophyceae which was followed by *Lyngbya* with 6 species and *Chroococcus* with 5 species. *Navicula* was the largest genus with 8 species of the group Bacillariophyceae consisted of *Cymbella* with 6 species and *Fragilaria* and *Pinnularia* with 5 species each. *Euglena* was the dominant genus with 7 species among Euglenophyceae followed by *Phacus* with 3 species. Among the group Xanthophyceae, *Ophiocytium* with 3 species was the dominant genus. The class Chrysophyceae, was represented with 3 genera, *Dinobryon*, *Phaeoplaca* and *Synura*. Dinophyceae was represented by single species *Ceratium hirundinella*.

- ❖ Of the studied aquatic bodies, highest algal species richness was observed in the study site S 4 (187 species) followed by the pond S 5 (143 species). Considering algal species richness, the ponds could be arranged as-S 4>S 5>S 2> S3>S 1. The water bodies directly contaminated with crude oil harboured comparatively less algal species.
- ❖ Distinct seasonal changes in algal community composition was observed. Except during the premonsoon season in the study sites S1 and monsoon season in S 3, chlorophycean algae were dominant in all the study sites throughout the year.
- ❖ The pond S4 showed highest mean average algal density followed by S5. Study site S1 showed lowest mean average algal density among the water bodies. The sequence of algal density among the study sites was- **S4>S5>S2>S3>S1**. Algal density showed seasonal variation in all the studied ponds. Higher algal density was observed during postmonsoon season and lowest was recorded either in premonsoon or in monsoon season.
- ❖ GPP was recorded highest (6.13 mg/l) in the site S 4 during monsoon and lowest (1.54 mg/l) in S 1 during winter. In terms of GPP the study sites may be arranged as- S4>S5>S3>S2>S1.
- ❖ NPP was highest (4.14 mg/l) in the site S 4 during postmonsoon and lowest (0.53 mg/l) in S 3 during premonsoon season. In terms of NPP the study sites may be arranged as- S4>S5>S1>S2>S3.
- ❖ Highest concentration of TOC was recorded as 29.14 mg/l in S 3 during winter and lowest as 0.69 mg/l in S 4 during monsoon season. Higher concentrations of

TOC were recorded in the ponds S 1 to S 3 located near oil exploration and production sites. Considering total oil content, the study sites could be arranged as-S1>S3>S2>S5>S4.

- ❖ Highest similarity index (0.47) was observed between study sites S 2 and S 4 and lowest value (0.08) was observed between S 1 and S 4.
- ❖ Hierarchical cluster analysis (HCA) revealed two distinct groups, one group was constituted of oil contaminated study sites S1, S2 and S3 and the other group constituted of non oil contaminated study sites S4 and S 5.
- ❖ Shannon and Weaver Diversity Index in the studied ponds were varied from 0.13 in S 1 to 3.14 in S 5. Low diversity index indicated higher organic pollution in all the studied ponds. Considering values of Shannon and Weaver diversity Index, the study sites could be arranged as- S5>S4>S2>S3>S1.
- ❖ The mean average evenness index was highest in the study site S 4 (0.58) and lowest (0.06) in site S 1. As per Pielou's evenness indexes the ponds may be arranged as-S4>S5>S2>S3>S1.
- ❖ Palmer's pollution indices for all the study ponds were above 20. It was recorded maximum of 35 in the study site S 4 and minimum of 28 in the study site S 5. Palmer's pollution indices indicated that all the studied ponds were highly organically polluted. As per Palmer's pollution index values among ponds may be categorized as- S4>S2>S3>S1>S5.
- ❖ Pearson's correlation coefficient analysis revealed that water quality parameters were positively or negatively correlated with each other at different level of significance. It was also observed that pH, turbidity, DO, free CO<sub>2</sub>, COD, chloride and calcium were significantly correlated with algal density. Increasing algal density also significantly raise net primary productivity (NPP).
- ❖ The CCA plot showed that the algal taxa were well separated along both axes indicating different physico-chemical demands of different taxa. The water quality parameters were also differently distributed, which allowed the separation of algal genera at different seasons.
- ❖ Significant presence and regular occurrence of chlorophycean genera *Eudorina*, *Haematococcus*, *Scenedesmus*, *Cosmarium*, *Ankistrodesmus*, *Botryococcus*, *Coelastrum* and *Chlorella*; Cyanophycean members *Oscillatoria*, *Microcystis*,

*Chroococcus*, *Aphanothece*, *Coelosphaerium*, *Lygnbya*, *Aulosira*, *Cyanosarcina*, *Phormidium* and *Gloeocapsa*; Bacillariophycean member *Navicula*, *Synedra*, *Pinnularia*, *Gomphonema*, *Fragilaria*, *Cymbella* and *Nitzschia* and Euglenophycean members *Euglena* and *Phacus* in oil contaminated ponds S 1, S 2 and S 3 indicated that they are tolerant to crude oil pollution.