Chapter-6

SUMMARY AND CONCLUSION

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Water is most vital for all living organism and important factor for aquatic ecosystem. The present study has highlighted the various physical and chemical parameters of Kalpani Beel, Assam. Seasonal variations in water quality were observed. The result revealed that the water quality of the Beel was deteriorated during winter season. Among the twelve parameters analyzed it was found that the Physical and chemical properties of p^H, FCO_2, TH, TA, NO_3^- and NO_2^- are above the WHO and BIS (Bureau of Indian standards) standard limit due to discharge of sewage, domestic wastes, fertilizers and pesticides from agricultural practices disturbing the ecology of the Kalpani Beel and Potable (Pure) nature of the water. Hence, we can conclude that the water of the Beel is polluted in winter season. But in monsoon season it again comes to normal condition. The Beel is feed with flood of the river Manas through inlet and outlet channel. From the above finding, it is clear that there is a distinct seasonal variation in selected physical and chemical parameter's in water. The correlation coefficient indicates positive and negative correlation of physical and chemical parameters of water with each other. So, from the overall study, it can be concluded that the health status of water in winter season is significantly inferior. The reason may be due to high level of anthropogenic activity and poor maintenance of this water body. After studying all the parameters, it can be concluded that the ecological condition of water is better in pre monsoon, monsoon and post monsoon than winter season. Water quality is dependent on the type of the pollutant added and the nature of self purification of water. The study may be helpful in best utilization and sustainable management of the Beel. Removal of aquatic weed (water hyacinth) should be practiced at regular intervals to control the nutrients level and silt deposition. Pollution due to various anthropogenic activities needs to be checked and awareness regarding the conservation of the Beel has to be generated.

The Fish diversity is a good indicator of health of aquatic ecosystem. The rich fish fauna of the Beel indicates the high productivity of the Beel. Result of the study indicated that the fish diversity of Kalpani Beel is extremely rich. Kalpani Beel is host a number of fresh water species and includes even globally threatened fish species. The Beel has one endangered species which have rare occurrence in the natural habitat and receives a high demand in the market. It is a safe and suitable breeding ground for river fishes. Therefore, it is also suitable habitat for the aquatic flora and fauna and for the production of fishes as well. Fishes are caught for the use of food and nutrition. The fishes not only give nutrition but also generate economy and build up livelihood of the poor people. But, to date, the production of fish species has declined as complimented by fisherman communities living in and around the Beel due to over use and human interference or economic profit. The fish species living in the Beel are also under threat due to several other anthropogenic factors. Over fishing, habitat destruction and immature fishing are main causes of loss of many fish species. Seasonal variation, anthropogenic activities, encroachment for paddy cultivation, climate change (extreme heat and cold), incursion of exotic species, fishing nets with small mesh size, drought and water pollution are some causes for loss of many fish species. Fishes maintain aquatic ecosystem hence there is need for conservation strategies. To protect diversity, people's consciousness is must and they will learn to use resources without causing any harm to those resources. Proper management of the Beel is necessary to improve the present status of the fish diversity. Over fishing occurs due to high fish prized in the markets. Community fishing in Kalpani Beel should be prohibited which is considered illegal under wild life (protection) Act of 1972. Since the Beel supports the livelihood of several economic classes the fish fauna in this region, there is an urgent requirement for incorporating conservation strategies for the protection of this beautiful natural habitat. Therefore, it is an urgent and strict need of conservation measures to save fishes species in this wetland.

The studies on aquatic macrophytes are important to limnologist in order to know the variable of the aquatic ecosystem. Aquatic macrophytes also provide food for fishes. The study on macrophytes diversity of Kalpani Beel from February, 2017

to January, 2018 in which 67 species representing 35 families belonging to 6groups such as 3 submerged suspended, 8 free floating,10 submerged anchored,10 emergent anchored,11 rooted with floating leaves and 25 swamp and marshy. Based above results it can be concluded that macrophyte diversity of the Kalpani Beel is very rich in compare to the other parts of country. The plan of this work has therefore undertaken the document of the aquatic macrophytes of Kalpani Beel. The check list generated in the study will work as a support to further researches in wetlands in the future. It provides useful information about water quality and aquatic ecosystem health. However, only long term studies of macrophyte changes can provide important information about changes in water. Therefore, long-term studies in aquatic macrophytes in the Kalpani Beel will be necessary and proper conservation measures should be taken for survival of this unique wetland.

Mineral salts are important for normal growth and other metabolic activities of the body. Animals cannot produce them in their body, and hence mineral salts are acquired through food (Das and Chakraborty, 2007). Fish may obtain these minerals from the diet (Watanabe *et al.* 1997). The results of the mineral analysis shown that *Hydrilla verticillata* is a good source of all essential minerals such as Ca ,Cu, Co, Cr, Fe, K, Mg, Mn, Mo, Na, and Zn. It is evident that they are important sources of essential minerals in reasonable concentrations, which is required in the food formulation of fish. The permissible limit for trace elements set by FAO/WHO (1984) in edible plants was 0.300 mg (Syed and Coombs, 1982). In this studied, the *Hydrilla verticillata* plant was found to contain the trace elements below the permissible limit. However, more detailed analysis of chemical composition of these plants is required. Minerals are essential elements involved in the normal metabolism of fish. The information currently available is very poor. The hurdle lies in the fact that these minerals are required only in trace amounts and under experimental condition, it is difficult to maintain such mineral amounts in formulated diets. This is the first endeavor that such an exhaustive work on mineral content has been carried out on the aquatic plants of Assam, India.

Photosynthetic pigments are important for the conversion of light energy into chemical energy that exists within the chloroplasts of plants. Chlorophylls, the

green pigments of plants, are the most important pigments active in the photosynthetic process. Chlorophyll a and b are the best recognized. Carotenoids are also photosynthetic pigments which include the pigments of carotene and xanthophylls group. Different pigments like chlorophyll a, b and carotenoids absorb light energy ultimately transferred to chlorophyll a, which is the main pigment; all other photosynthetic pigments are accessory pigments. The result of the study indicates that four (4) photosynthetic pigments were determined/identified in the *Hydrilla verticillata* plant (submerged aquatic plant) namely chlorophyll a, b, carotene and xanthophyll. The absorption spectra of chlorophyll a and b were peaks-1 and 2 (642-662nm) and peaks-6 and 5(435-453 nm) that indicate the present of chlorophyll a and b respectively. Moreover, the absorption spectra of carotenoids were peaks 3 and 4 (533-570 nm) that indicate the present of carotene and xanthophylls in the *Hydrilla verticillata* plant. The absorption spectrum of chlorophyll and carotenoids provides indirect data of the wavelengths of light that are absorbed for the process of photosynthesis. Often the wavelength positions of the peaks may vary by a few nanometers with chlorophyll extracted from different species. So, from the overall study, it can be concluded that chlorophyll content can be taken as an index of photosynthetic productivity of *Hydrilla verticillata* plant.

Natural food, obtainable in the water body, alone is not sufficient to get fast growth of fish. To make aquaculture economically possible it is very important to formulate suitable supplementary feeds using economical and nutritionally balanced diet which can fulfill the nutritional requirements of fish in order to minimize the cost by avoiding nutrient wastage (Lovell, 1972; Sneed *et al.* 1972). Experimental diet incorporated with *H. verticillata* is an ideal and palatable feed for *L. rohita* fishes. Adequate amount of protein, fats, fiber and energy in the experimental diets is suitable for fulfilling the daily dietary requirements of fishes. Among the three experimental diets H40 diet yielded the best positive results compared to the H30 and H50. This indicates that an optimum level of incorporation which is 40 percent (H40 diet) is an ideal amount of incorporating *H. verticillata* in fish diet for obtaining proper growth and development. Fingerlings

of *L. rohita* grow well on diets containing 27% to 35% protein as a consequence of optimum percentage of protein and efficient utilization of diets. Cost of the feed could be cut down up to 71% by incorporating *H.verticillata* in the fish feed. The feed prepared with *H.verticillata* have a good acceptance and palatability among *L. rohita* fishes. The results suggest that *H. verticillata* incorporated diet can be beneficially used as feed for fishes to obtain better production.