Cosmarium paulii, *C. stigmosum* (Nordst.) Turner var. hakalukiense, *Euastrum sinuosum* Lenorm. var. hakalukiense, and *Staurastrum pinnatum* Turner var. hakalukiens new to science. Thus, the amount of genetic diversity waiting to be explored in this part of the world may be quite high. Recently, a six-month study (June-December) was conducted on the water quality and phytoplankton of Tanguar *Haor* to understand the effects of floods on *haors* (Muzaffar and Ahmed, 2007). This study highlights the fact that this *haor* is still an undisturbed ecosystem given the extent of degradation in many major water bodies of Bangladesh.

In the 1990's, biodiversity was monitored in detail in several *haors* on a few occasions (FAP 6, 1995; NCSIP-1, 2001a, b). Scientific research carried out by different research organizations focussed mainly on fisheries resources. Fisheries data are also collected occasionally from different *haors* in different socio-development projects. Most of these data are, however, not available due a lack of appropriate database management.

What are the scopes of studying *haors*?

The limnological studies in Bangladesh are mostly done by the university departments of botany, zoology, fisheries and environmental sciences. Because of their limited resources and experts, most of such departments work in a restricted number of geographical areas and ecosystems. Therefore, there are limited number of studies in *haors* on fisheries and general limnology. Nonetheless, with superb dynamism, rich biodiversity and importance to national economy, these water bodies are, indeed, suitable sites for undertaking limnological and fisheries research.

Since Bangladesh is a low-lying country, effects of climate change and climate variability have so far been emphasized largely on coastal areas (salinity, water-logging, natural calamities) and northern areas (droughts). But given the impacts of climate variability on waters, *haor* basin could be a very suitable object for research studies, with especial emphasis on aquatic protein yield, since in Bangladesh 80% of animal proteins comes from fish.

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No Need to Reduce Nitrogen for Eutrophication Mitigation: Findings of a Long-Term Limnological Study in China

During a long-term study on 45 shallow lakes in Yangtze area (China), the research group headed by Prof. Hong-Zhu Wang tested whether N can be the long-term limiting nutrient in the field. The results (Wang et al., 2008) indicated that it is P (Phosphorus) and not N that determines the amount of total phytoplankton in the lakes on a long-term scale. For a given amount of total phosphorus (TP), phytoplankton chlorophyll a (Chl *a*) varies regardless of the changes of total nitrogen (TN; Figure 1).

However, for a given amount of TN, Chl *a* increases rapidly with the increase of TP (Figure 2).

These findings at odds with the prevailing idea to use the ratio of N to P as an index to discriminate if lakes are N- or P-limited. Importantly, the findings of this study reveal that N reduction may fail to decrease phytoplankton in the lakes.

The findings over several lakes (Wang et al. 2008) are supported by the ongoing experiment for >35 years in Lake 227, a small lake in the Experimental Lakes Area (ELA: Winnipeg, Manitoba, Canada). In these lakes, Schindler and his associates have clearly demonstrated that P inputs alone control algae blooms (Schindler et al. 2008). In the present study we show that if N inputs are decreased without decreasing P inputs, blooms of N-fixing algae increase even more. Given enough P and time, N fixation was sufficient to allow biomass to continue to be produced in proportion to P, and the lakes remained highly eutrophic.

From regional comparisons and long-term monitoring data we can generalize that reduction of N loading alone cannot decrease the amount of total phytoplankton, and only phosphorus control can effectively mitigate the problems of eutrophication and recurrence of cyanobacteria blooms. The N_2 gas can be fixed through natural process (including lightning and biological N-fixation) to offset any N deficiency in aquatic systems. Roughly half of the global input of newly- fixed nitrogen

Fig. 1: A view of Lake Qiaodunhu that is located south of the middle Yangtze River and 27km northwest of Daye City, Hubei Province, P.R. China (114°39'-49'E, 30°12'-18'N; area, 8.0 km^2; Z_{Max}, 3.3m; Z_{Mean}, 2.1m). The Photo was taken soon after the lake had experienced a shift from a macrophyte-dominated state to a phytoplankton-dominated state in the autumn of 2006. The shift was triggered mainly by high stocking rate of Chinese mitten crab and high input of fertilizer.

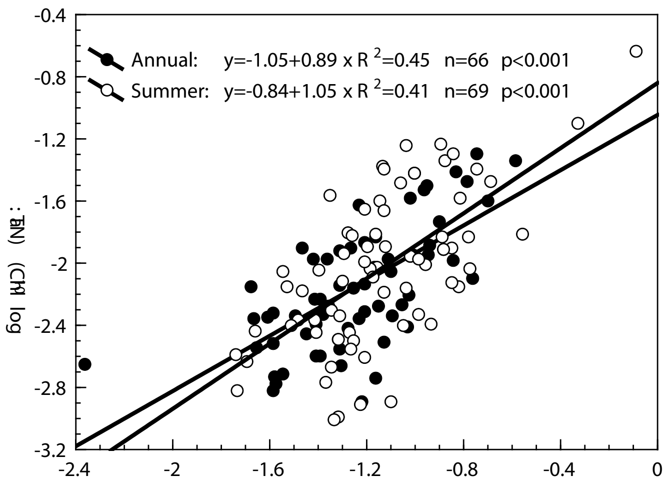

Figure 2

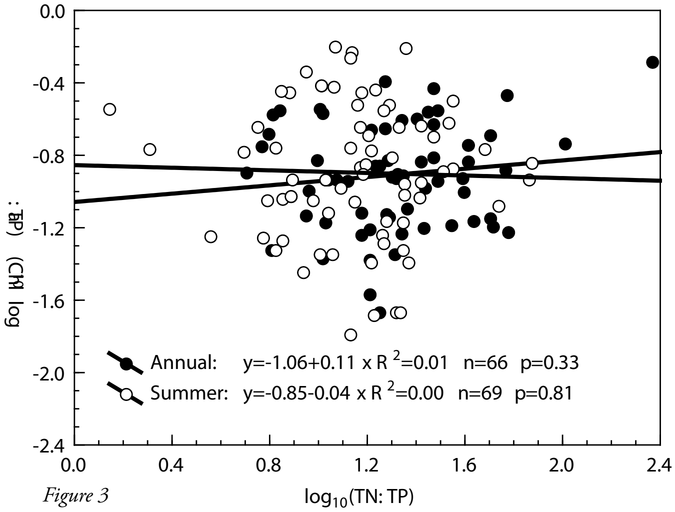

Figure 3

Figures 2 and 3: Relationships between ratio of chlorophyll a to total phosphorus (Chl a/TP) and ratio of total nitrogen to total phosphorus (TN/TP) (1) and between Chl a/TN – TP/TN (2).

(including industrial production of N fertilizer) can be attributed to natural processes. However, there is no such natural mechanism for P to compensate for P deficiency. Moreover, solubility in water of P compounds present in lakes is usually low.

In short, in lake management studies aimed at reducing eutrophication, the focus must be on decreasing inputs of P. Whereas to promote growth of phytoplankton, both N and P are essential, to limit phytoplankton growth, only P control is sufficient. Thus, there is no need to reduce N for eutrophication mitigation, except when N concentration is too high to induce direct toxic impacts on human or other organisms. Lastly, by focusing on P control, the cost to mitigate eutrophication can be greatly reduced.

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The Coastal Lakes of South Africa

South Africa has no lakes of tectonic origin of the scale of the Great Rift Valley Lakes. Only L. Fundudzi in the Limpopo Province may just qualify as it was formed by a natural rock fall that blocked the flow of a river. The extensive and dramatic inland delta, the Okavango Swamps, owes its origin to tectonic activity extending from the Great Rift Valley.

The remaining natural lakes are largely shallow depressions or *pans* on the elevated post-Gondwana landscape called the Highveld, and a necklace of coastal lakes and barrier lagoons set within the verdant luxury of an extensive dune cordon that stretches in an interrupted manner along the coastline of KwaZulu-Natal, the Eastern Province and the Cape south coast. These varied limnological sites are shown in Figure 1.

Each lake system owes it origin to falling sea level during the Flandrian glacial period when the continental shelf of South Africa became increasingly exposed and allowed the coastal rivers to extend their reaches across its sandy floor. With the end of the Flandrian period, melting ice caused the sea to once again transgress across the shelf and because of the marked temperature difference between the land and the cold seas, strong winds were set that built the dune cordons behind which barrier lagoons formed and through which rivers formed estuaries.

By the Holocene the coastal lakes were formed, although much more ex*pans*ive than at present. Gradually their volumes and surface areas were reduced by segmentation. Linked to this process was a gradual sealing of the river channels from their estuaries and with the increase in the proportion of freshwater the lakes passed from salty to brackish and in the case of L. Sibaya on the peneplain of KwaZulu-Natal fresh, with the merest hint of its former salinity through an elevated chloride signature, to freshwater.

The physical and chemical limnology of the lakes varies considerably. Some are shallow systems while others are deep as Lake Sibaya and L. Nhlange with basins below and the surface of the lake well above sea level that show weak stratification in summer. A detailed analysis of the bathymetry and other geological features of L. Sibaya are given by Miller (2001). Yet others are meromictic with deep saline monimolimnia sustained by the occasional ingress of seawater as found in Swartvlei on the Cape South coast and L. Mpungwini, one of a chain of lakes making up the Kosi system of northern KwaZulu-Natal. The meromixis in L. Mpungwini is permanent, only disturbed by infrequent storms; that of Swartvlei is easily eroded by seasonal winds and reset by tidal flows when the estuary mouth is open.

All are invariably oligotrophic, frequently in association with peat stained surface inflows as in the case of Swartvlei, or because of their dependence upon aquifer discharge (Colvin et al. 2007) and rain to maintain water levels, they are clear water systems, with an elevated sodium level, above that introduced by cyclic salt.

The best known lake phytoplankton array is that of L. Sibaya that was described by Hart and Hart (1977) in which they point to the importance of nanoplankters in the operation of the community: a feature that has been confirmed in later studies of estuarine - lake systems. And of particular interest and significance are R.C.Hart's intensive studies of the