GLEON 11 Student poster abstracts

Kamal ASIF[1] and Hifzur Rahman[1]

A Geospatial Survey of Lentic Aqua Systems in the Upper Gangetic Plains and Investigating the Root Causes of Biodiversity Loss – *Case of Sheikha Lake.*

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The Lentic aqua systems or wetlands are the productive ecosystems which are attributed as invaluable treasures of biodiversity. In India these aqua systems are distributed in varied geographical regions that range from the cold arid zone of Laddakh to the wet humid southern peninsula and from the hot arid zone of Gujarat-Rajasthan to the tropical monsoon region of north-east India. The upper Gangetic plain is the part of Indo-Gangetic Plains which possesses the largest system of wetlands in the country. Sheikha Lake is one of the important aquatic ecosystem lies in the catchment of the river Ganges. It is an important bird watching site covering an area of about 4 sq km, of which the water spread area is 2 sq km. The lake is one of the favorite wintering centres for migratory birds that came as far as from Arctic-Siberia. Besides the availability of large number of floral and faunal species in the lake, makes it a complex ecosystem functioning as both aquatic as well as terrestrial habitats. Unfortunately, Sheikha and other similar aquatic systems of the Upper Gangetic plain are undergoing impulsive alterations in the form of habitat loss and degradation, which is the proximate cause of biodiversity loss. To provide the basis for implication of more effective conservational approach, the paper argues to frame out the ground information with geospatial data. The geospatial mapping of lakes and wetlands provide authentic answers of the problems related with temporal change, climate, encroachment, pollution, siltation, weed infestation, aquaculture etc. Moreover helps in managing the ecosystems for protecting endangered species, nesting and breeding of birds, natural landscape and for ecotourism.

Lucas J. BEVERSDORF[1,2] and Katherine D. McMahon[1,2]

N_2 fixation structures cyanobacterial community composition in Lake Mendota, WI, USA

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Lake Mendota is an eutrophic lake that harbors an abundant and diverse array of bloom-forming cyanobacteria. The cyanobacterial community composition (CCC) is highly variable, contains numerous nitrogen fixing and non-nitrogen fixing genera, and has multiple genotypes capable of forming stochastic, and possibly toxic, blooms. Nutrients play an integral role in the CCC, but it is unclear how phosphorus (P), nitrogen (N), and trace metal limitation might influence intra annual community dynamics. Biological dinitrogen (N_2) fixation gives N_2 fixing cyanobacteria a clear advantage over non-N_2 fixing cyanobacteria. However, dissolved organic nitrogen (DON; e.g. glutamate) is often leaked out of the cell during N_2 fixation, which may further subsidize a non-N_2 fixing bloom. We measured N_2 fixation, toxins, and several other chemical, biological, and physical

parameters that may contribute to structuring the CCC in Lake Mendota. Shortly after lake stratification, nitrate concentrations dropped, and N_2 fixation rates increased. Once inorganic N and P approached detection, N_2 fixation was episodic with the N_2 fixing and non-N_2 fixing genera strongly anti-correlated. Additions of P and iron did not stimulate N_2 fixation, but instead decreased rates. Preliminary results suggest that following P addition, cyanobacteria stopped fixing N_2 to store P as polyphosphate. Together, these results have large implications for the role of N_2 fixation in CCC, the formation of potentially toxic blooms, and the protection and sustainability of recreational waters.

Linlin CAI[1, 2], Zhu Guangwei[1]

Effects of water temperature and nutrients to algal biomass during the bloom seasons in Taihu Lake

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Annual changes during bloom seasons (May to August) of nutrients and phytoplankton chlorophy11-*a* (Chl *a*) in Taihu Lake, a shallow lake, were analyzed using the monthly investigated data from 1999 to 2007. And the change of effective accumulated water temperature (EWT) was studied by daily monitoring data. The concentrations of nutrients and Chl *a* showed high temporal variations in the lake from high values Meiliang Bay towards lower ones the Open Lake. From 1999 to 2007, annual averages of total nitrogen (TN), total phosphorus (TP), Chl *a*, and EWT were gradually increased year by year. Chl *a* changes were linearly correlated to changes EWT, NO_x and TP in Meiliang Bay, but were not correlated to changes in the concentrations of other nutrients in the water column. In the Open Lake, only TP was linearly correlated to the concentrations of Chl *a.* A multiple stepwise linear regression revealed that in Meiliang Bay, PO_4, DTP, TP, and SD explained 95% (DW=2.19) of the variation of Chl *a*. WT, NO_x, DTP, and SD explained 93% (DW=2.13) of the concentrations of Chl *a* in the Open Lake In these systems, the important role of WT and nutrients in algal bloom must be considered for the understanding and management of large shallow inland lakes.

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The effect of cyanobacterial blooms on lake ecosystems may be determined by trophic status

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One of the most common paradigms in limnology is that cyanobacterial blooms reduce the species richness and biomass of non-blooming phytoplankton and, by being poor quality food, decrease zooplankton grazing. Modeling and experimental work have indicated that the diversity of non-

blooming phytoplankton during cyanobacterial blooms is low because cyanobacteria produce surface scums that limit light penetration, excrete allelopathic chemicals, and fix their own nitrogen; all mechanisms that allow cyanobacteria to outcompete other phytoplankton. However, recent research has indicated that the effects of cyanobacterial blooms are more complex and context-dependent than previously realized. For example, allelopathic screenings of cyanobacteria have demonstrated both inhibitory *and* stimulatory effects on other phytoplankton. Furthermore, a growing number of studies indicate that cyanobacteria *can* stimulate the growth and division of other, more edible phytoplankton in both laboratory and field settings. These findings have major implications for our understanding of food webs and nutrient cycles during cyanobacterial blooms. Why do some systems exhibit inhibitory and other systems exhibit stimulatory effects of cyanobacterial blooms? The majority of the studies of inhibitory blooms were conducted in eutrophic and hypertrophic systems, while the studies of stimulatory blooms were primarily performed in more nutrient-limited systems, indicating that nutrient limitation may be an important determinant of how cyanobacterial blooms affect a lake. Here, I present experimental data indicating that the effects of cyanobacterial blooms on lake ecosystems may be driven by trophic status.

Samuel B. FEY[1], Kathryn L. Cottingham[1]

Direct and indirect effects of climate change mediate the future establishment of *Daphnia lumholtzi* through altering biotic interactions

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Accurately predicting the ecological consequences of climate change requires an improved understanding of how community processes, including indirect effects, respond to alterations in temperature and other climate variables. To understand the role of climate change in facilitating the future establishment of the non-native cladoceran *Daphnia lumholtzi* in North America, we examined the effects of increased temperature and increased severity of cyanobacterial blooms on the interaction between *D. lumholtzi* and native *Daphnia pulex.* Laboratory competition studies showed the importance of temperature and food source on the interaction between zooplankton species. In the absence of competitors, *D. pulex* (but not *D. lumholtzi*) exhibited reduced performance in the presence of elevated temperature (27^{O}C versus 23^{O}C), and when fed *M. aeruginosa* and *A. flos-aquae*. However, in the presence of competitors, *D. pulex* emerged as the superior resource competitor to *D. lumholtzi* when the zooplankton where fed *A. flos-aquae* and *M. aeruginosa,* but not when fed a high-quality phytoplankton (*Scenedesmus acutus)*. We predicted that if biotic interactions were an important factor for the establishment of *D. lumholtzi, D. lumholtzi* would perform best in the absence of cyanobacteria in a field experiment. A 35 day field mesocosm experiment revealed that *D. lumholtzi* performed best at high temperatures in low cyanobacteria environments when interacting with *D. pulex*. Taken together, our results indicate that while *D. lumholtzi* may benefit from the predicted increases in temperature, its future establishment may be limited by an increase in severity of cyanobacterial blooms.

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PRELIMINARY STUDY OF THE PHYTOPLANKTON AND ZOOPLANKTON OF THE SAUCE GRANDE SHALLOW LAKE, ARGENTINA, DURING AUTUMN 2010

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Sauce Grande shallow lake (38°57' S - 61°24'W) is located in the Southwest of the Buenos Aires province, Argentina. It is a typical pampean plain lake without thermal stratification. The aim of this work was to study the composition and abundance of phytoplankton and zooplankton communities of the Sauce Grande shallow lake during autumn 2010. Phytoplankton and zooplankton samples were collected at monthly intervals from March to May,2010, at three stations: in the entrance of the river, the river's exit and sector more deep. Phytoplankton samples were taken both with bottles and net (30µm mesh) and were fixed with lugol for quantitative analysis and with formaldehyde (final concentration 0.4%) for its qualitative study. Chlorophyll-a was measured with a spectrophotometer in accordance with APHA (1998). For zooplankton sampling, an oblique tow was performed at each station using an open conical net with a 0.30 m mouth diameter and a 200µm mesh. The tow was made at a speed between 3 and 5 knots during 5 min. The material collected was immediately preserved in a 4% formaldehyde solution. Total phytoplankton abundance ranged from 84541 to 340666 ind.ml^{-1}. Chlorophyta was the more widely represented algal group in terms of number of taxa for the entire study period. Additionally, *Planctonema lauterbornii* Schmidle (Chlorophyta) was the dominant species. There were no major qualitative and quantitative spatial differences in phytoplankton during the study period. Total zooplankton abundances varied from 19496.71 to 100088.64 ind.m^{-3}. The highest values were recorded in warmer months and the lowest ones in the cold ones. Copepoda (especially calanoid copepods) and Cladocera were the most important zooplanktonic groups. Cladocera was present in March and its abundance decreased towards May, where calanoid copepods always dominated the zooplankton community. In relation to the spatial pattern of zooplankton organisms, there was not observed a clear pattern between sampling stations.

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Comparison of nutrient loading and eutrophication between two large, tropical reservoirs with cyanobacterial blooms

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Abstract: Both Gaozhou and Dasha reservoir are large-scale reservoirs in which cyanobacterial blooms occurred the first time in 2009 and 2005, respectively. In 2009, we performed monthly physical-chemical analysis of the water, phytoplankton abundance of both reservoirs, as well as non-point pollution source budget in these catchments. Compared with 2000, both TSI and phytoplankton abundance have significantly increased, classified as eutrophic. A study of non-point pollution sources shows that fertilizer loss from paddies and forest contributes most total nitrogen (TN) and total phosphorus (TP) in Gaozhou basin; however, fertilizer loss from woodland and animal husbandry produced most TN and TP input in Dashahe. Nutrient loads were calculated in these catchments. Though more nitrogen and phosphorus were inputted into Gaozhou reservoir, result shows greater nutrient loads in Dashahe catchment, with value of 63.4 t/km^2 TN and 12.2 t/km^2 TP; however, it was 41.1 t/km^2 TN and 5.8 t/km^2 TP loads in Gaozhou reservoir, whichi supports our hypothesis that high nutrient loading accelerated cyanobacterial blooms occurring, especially in Dashahe reservoir. The data presented here should be taken as a basis for more detailed studies on abatement of nutrients input with an aim to provide safe water, as well as supplying guidelines for reservoirs and catchments management.

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Metabolic model parameter uncertainty explained by GLEON Lake Analyzer stability indices

***Presenter**

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Metabolic models are used to predict dissolved oxygen concentration in lakes. We hypothesize that when these models fail to accurately predict dissolved oxygen dynamics in lakes, poor model fit may be explained by changes in physical stability (e.g. mixing event). We investigated the relationship between metabolic model parameter uncertainty, physical drivers (photosynthetically active radiation, PAR, and wind speed), and physical stability indices. For most lakes, variance in ι (gross primary production model parameter) exceeds variance in ρ (respiration model parameter). PAR, which drives both metabolic model processes and lake stability indices, is negatively correlated to ι variance- most strongly for smaller lakes- and positively correlated to ρ variance - more frequently for larger lakes. A minimum threshold for PAR was identified for many lakes, below which ι parameter uncertainty In order to correct for low PAR days, and because PAR is correlated with higher parameter uncertainty on days when mean daily PAR < 150 µmol·s-1·m-2 in some lakes, we removed days below this threshold for subsequent analysis. After removal, Lake Number is most frequently and significantly positively correlated to ι parameter uncertainty for larger lakes, and is significantly negatively correlated to smaller lakes. For ρ parameter, PAR remains the most significant and frequent correlate of ρ variance, with Lake Number the second most frequently, positively correlated stability index. We hypothesize that lake size, mixing regime, and subsequent sensor foot print play a role in these trends.

Samuel KIBICHII[1]

Towards a sustainable monitoring program for the saline-alkaline Lake Nakuru ecosystem ii: the case for high frequency monitoring data collection

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The high surface-area to volume ratio in shallow tropical lakes makes them to easily and rapidly respond to hydrologic changes in their watershed. For Lake Nakuru, increased rainfall in the watershed, and the corresponding increases in river discharges into the lake, result in ionic dilution, increased nutrient loading from the watershed and a corresponding increase in primary production. Reduced rainfall and the subsequent drying up of rivers draining into the lake, on the other hand, causes ionic concentration, increased conductivity and a change in the phytoplankton community towards dominance by the microcystin-producing *Microcystis sp.* During the driest months harsh environmental conditions in Lake Nakuru associated with increased conductivity cause fish and flamingo deaths regularly. Managerial interventions aimed at conserving the unique biodiversity of this saline-alkaline lake, whose flamingo populations can reach over one million birds during optimum conditions, have been hampered by a lack of a good quality data set that can be used to establish the tipping point beyond which lose of flamingos cannot be prevented. A review of low-frequency data collected by the SUMAWA project and the Earth Watch Institute show that forthnightly- and monthly-collected data often miss the onset of the series of events that lead to lose of birdlife. It is suggested therefore that a high-frequency data collection regime will help in establishing the minimum lake depth that must be maintained to mitigate against biodiversity loses. A hydrological intervention involving water retention in upstream dams which allow slow, regulated releases during the driest months to maintain the desired depth can then be developed.

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Establishment of Korean Lake Ecological Observatory Network (KLEON)

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Goal of KLEON is to establish an ecological observatory network by sharing lake observation, managing observatory information, and supporting analysis tools.
In order to understand and predict the change of the ecosystem in lake, river, and wetland, it is required for a lake ecosystem monitoring system to manage the various kinds of observation data, which is collected from buoys and sampling sites.
To get the condition of lake and river, we are installing the water quality sensors such as temperature, conductivity, pH, LDO, TDG, and turbidity at the selected Korean observatory (Lake - Soyang, Euiam, Youngrang, River -Anyang, Han, Gapyeong).

KLEON provides a graph, xml format, and CSV file to check the sensor data on the web, which is transmitted from the buoys in nearly real time. KLEON also manages the sampling data such as water quality and plankton with the vega model of GLEON (Global Lake Ecological Observatory Network). 34 kinds of sampling data types and a variety of plankton data are collected to check the water quality. These collected observations are used to analyze the phenomena such as the eutrophication evaluation, turbid water evaluation, and the cause of fish kill.

To give the additional information for observation, KLEON handles the installed sensors, the observation site, lake, dam, floodgate, and weather. For example, the sampling data is affected by the condition of sampling site such as heavy rain, construction, and sensors' sampling method. The SensorML (Sensor Model Language) of OGC (Open Geospatial Consortium) is used to describe the sensors' attributes such as model no., sampling interval, and the error rate of the sensors. The information of the observation site, lake, and dam is handled with data management service on the web. To get the floodgate and weather data, a graph and CSV files on the web interface are also provided. This observatory information is useful to clearly understand the observation.

When a user search the observations and the observatory information, the web interface using Google earth is useful to give the spatial information of the observatory such as the positions of sampling sites and the shape of lakes.

We really hope that KLEON is used to support the various kinds of area such as ecological community, national policy, and science. For example, the collected observations and data management technology are useful to support the global cooperation with GLEON and KEON (Korean Ecological Observatory Network). Information technology of KLEON is used to support the real time data management for ecological research, data standardization, data integration with climate data, and visualization & simulation. The observations and analyzed result is effective to make the national policy such as environment preservation policy, green development, and pollution prevention. The result of lake ecosystem health assessment will lead to the development of the environment/ecology research by improving the accuracy of water quality model and updating teaching resource.

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Significance of bacteria in regulating phytoplankton populations in Lake Kinneret (Israel)

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Compared with other microbial interactions in freshwater ecosystems, the microbial loop has received little attention, yet increasingly researchers are documenting that the microbial loop plays an important role in nutrient cycling in freshwater and marine ecosystems. In this paper, we examine the significance of key microbial loop processes on the Lake Kinneret ecosystem by applying a one dimensional coupled hydrodynamic-ecosystem model (DYRESM-CAEDYM). Three microbial loop configurations are presented, including direct organic matter mineralization (no bacteria state variable, NOBAC), bacteria included but without dissolved inorganic nutrient uptake (BAC-DIM), and bacteria with dissolved inorganic nutrient supplementation (BAC+DIM). The model simulations are compared against a comprehensive dataset (1997-2001) and, through comparison of the simulations, insights into the nutrient flux pathways between bacteria, phytoplankton and zooplankton are reported. The results are analyzed from a stoiciometric point of view and used to understand how significant these pathways are in shaping the algal succession within the lake. Considerable variation in algal stoichiometry of five species of phytoplankton and dissolved organic matter (DOM) demonstrated the predicted model results are highly sensitive to assumptions made in the microbial loop formulations, and suggested that dissolved organic phosphorous (DOP) is the key driver of microbial loop when bacterial growth is P-limited. Nutrient limitation functions for the five simulated phytoplankton groups of the BAC-DIM and BAC+DIM simulations were compared to confirm that bacterial competition for nutrients can switch the nutrient that limits algal growth and change the algal composition. The analysis therefore concludes that it is crucial to understand the role that the microbial loop plays in nutrient cycling as a potentially important model component that must be carefully parameterized when simulating phytoplankton and water quality dynamics in lakes.

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Use of high frequency data for heat flux and atmospheric stability calculations

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Computer modelling is frequently used as a part of a decision making tool to support lake management. Thermodynamics is one of the most important parts of lake dynamics and modelling. Lake Rotorua is one of 12 regionally significant lakes in the central North Island of New Zealand. A comprehensive modelling programme has been employed to examine relationships amongst land use and water quality in the lake. A monitoring buoy was established in Lake Rotorua in 2007. The resulting high frequency dataset can be used for accurate calculations of latent and sensible heat fluxes. Additional considerations of heat fluxes due to river inflows, outflows, short-wave radiation and long-wave radiation can be used to estimate geothermal heat flux by difference, as Lake Rotorua has significant inputs of heat from this source. A Matlab code has been written to calculate atmospheric stability to derive latent and sensible heat fluxes for the lake. In 2007 the model output indicated a high latent heat loss in summer but almost zero net sensible heat transfer over an entire year. This trend was most probably be derived from warm

and dry summer and wet and cold weather of winter. There was atmospheric instability for approximately 85% of the time, and atmospheric stability was most commonly observed in winter.

Jordan S. READ[1] and Chin H. Wu[1]

Trends in open-water evaporation from Trout Bog; a Long-Term Ecological Research (LTER) study lake

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Open water evaporation is an important regulator of lake temperature and water budget, as evaporative cooling drives surface water temperatures and decrements lake volume through an outward flux of water vapor. Evaporation is controlled by regional climate and local lake characteristics, varying along gradients of water color, wind sheltering and size. We have used a combination of the Bowen Ratio energy budget and aerodynamic methods to estimate open water evaporation for fourteen years on a small bog lake; a ubiquitous lake type in the northern temperate zone. The period of our analysis spans regional changes in precipitation, ice-cover, and air temperature. Data for water temperature, ice duration and wind speed were collected by the Northern Temperate Lakes Long-Term Ecological Research (NTL-LTER) program. Trends in Ice-cover duration were found to be significantly correlated with yearly evaporation (pvalue<0.05), as years with more ice-free days typically had higher cumulative evaporation over that period. The mean evaporation rate over the entire study period was 2.7 (mm day-1).

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Estimating dissolved organic carbon pools

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The project is using a combination of high resolution fluorescence data to estimate the phytoplankton and DOC pools and nephelometer data to estimate particulates, together with lower frequency sampling of the carbon pools in additional biological components. The collated data will facilitate application and validation of models of in-lake productivity and an assessment of future climate impacts on carbon cycling using downscaled climate change data which are available specifically for the study site. The initial stage of the project involves calibration of in-situ instrumentation to measure DOC fluorescence, including an assessment of the impact of temperature mediated quenching on fluorescence levels and establishing a carbon fluorescence

relationship. This will enable us to develop a more accurate carbon budget for Lough Feeagh and the Burrishoole Catchment.

Dirk SARPE[1]

Autonomous Negative Trends in IJssel- and Markermeer

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Fish and mussel eating bird numbers in the IJssel-Markermeer region (the Netherlands) are declining since the 1980s. This decline is correlated to a decline of their main food sources, smelt and zebra mussels, and a decline in nutrients especially phosphorus. This suggests a bottom up effect traveling up the food web. However total phosphorus concentrations still suggest an eutrophic system. This study investigates effects of re-oligotrophication in combination with other stressors on primary producers as well as primary and secondary consumers in the lab. First results suggest that cladocerans feeding on algae grown under low phosphorus concentrations, could not compensate the low algae quality even when food was abundant. Findings from the experiments are included in models and checked against the closely monitored ecosystems of the lakes. Several permanent monitoring stations gather continuously data of several abiotic and biotic variables, like phycocyanin, and are supplemented by plankton samples and fish trawls.

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Solar quenching in Lake Rotorua

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Chlorophyll-*a*(chl-*a*) is a key parameter for investigating phytoplankton distribution over vertical and horizontal scales. It is in situ measured by fluorescence sensor and then converted to chl-*a* concentration. The converted chl-*a* from measured fluorescence, however, is in part limited by non-photochemical solar quenching in daytime. The measured chl-*a* fluorescence is reduced in high solar irradiance environments, introducing variability into the calibration of chl-*a* fluorescence to chl-*a* concentration. On the basis of automatic monitor data of Lake Rotorua in the year of 2008 and 2009, we found night-up and day-down pattern of chl-*a* concentration. Then we chose low wind speed days to exclude the effect of disturbance. At last, we use statistical method to analyse the data to get the point of radiation where solar quenching happened, and how the chl-*a* changed when radiation become higher.

Li YAN[1,2] , Yongjiu Cai[1,2], Zhijun Gong[1]

Influences of habitat type and environmental variables on benthic macroinvertebrate communities in a large shallow subtropical lake (Lake Taihu, China

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We investigated benthic macroinvertebrate communities in three contrasting habitats of a large shallow lake from February to November 2009. The three habitats differed markedly in their environmental characteristics (e.g., trophic status, substrate type, wind exposure). A total of 36 species were collected from the three habitats. The calculated descriptors (abundance, biomass and Pielou evenness index) differed significantly among the habitats. Generally, Tubificidae, Bivalvia and Gastropoda dominated the benthic community in abundance and biomass, but they varied greatly in abundance among the habitats. Analysis of similarities (ANOSIM) and non-metric multidimensional scaling (NMDS) analyses revealed significantly different macroinvertebrate assemblages among the habitats. North Bays had the lowest biodiversity and were exclusively dominated by pollution-tolerant species (e.g., *Limnodrilus hoffmeisteri* and *Rhyacodrilus sinicus*). Communities in the open lake contained intermediate biodiversity and were characterized by five species belonging to several taxonomic groups (e.g., *Corbicula fluminea*, *L. hoffmeisteri* and Gammarus sp.). Macrophyte-dominated habitats (East Bays) presented the highest diversity and evenness and were mainly characterized by gastropods. A canonical correspondence analysis (CCA) demonstrated that habitat-specific differences in trophic status, pollution level, wind-induced disturbance and macrophyte distributions were highly correlated with macroinvertebrate community structure.

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Temporal-spatial variations of chemical oxygen demand and biochemical oxygen demand in Lake Taihu

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The temporal-spatial distribution characterization of chemical oxygen demand (COD), biochemical oxygen demand (BOD), and the relationships between COD, BOD and phytoplankton pigment, dissolved total nitrogen (DTN), dissolved total phosphorus (DTP) concentrations are presented based on the conventional monitoring data of COD, BOD, phytoplankton pigment, DTN and DTP from four seasons (winter: February; spring: May; summer: August; autumn: November) in 2009

including 32 samplings in Lake Taihu. The results showed that the COD concentration ranged from 3.40 to 6.16 mg·L^{-1} with a mean value of （4.38±0.72） mg·L^{-1} and the BOD concentration ranged from 0.64 to 5.93 mg·L^{-1} with a mean value of （1.91±1.63） mg·L^{-1}. COD concentrations in winter and autumn were significantly higher than those in spring and summer (ANOVA, $p < 0.001$), while BOD concentration was higher in winter and lower in other seasons. A significant spatial difference was found in COD concentration and BOD concentration, decreasing from Zhushan Bay and the river inflows of northwest Lake Taihu to Meiliang Bay, the central lake to the southeast lake basin. Apparently, COD and BOD concentrations were higher in the mouths of inflowing rivers and in bays, compared with the concentration in open water in Lake Taihu (ANOVA, $p < 0.001$). Seasonal differences of relationships between COD, BOD and DTN, DTP, phytoplankton pigment were discussed in this study. The highest correlation between COD, BOD and phytoplankton pigment concentration found in summer indicated a more important contribution of phytoplankton degradation to COD and BOD in summer than other seasons. The temporal-spatial distribution characterization of COD and BOD were affected by the rainfall, the river inflows, the hydraulic project “the Yangtze River-Taihu Lake Water Transfer Project” and the degradation of phytoplankton blooms in Lake Taihu.

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Microcystis-derived carbon and nitrogen flow in Meiliang Bay of Lake Taihu, China: An ^{13}C and ^{15}N labeling experiment

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We conducted mesocosm experiments using ^{13}C and ^{15}N enriched *Microcystis* detritus to track the fate of carbon and nitrogen derived from *Microcystis*. It was determined from $\delta^{13}C$ and $\delta^{15}N$ values that *Microcystis* could be utilized by other aquatic organisms. The results showed that zooplankton, larvae of *P. modeslus* and *Radix* could make a good usage of the carbon and nitrogen from *Microcystis*. Other aquatic organisms could also make use of carbon and nitrogen derived from *Microcystis*. Regardless of the way and mechanism, *Microcystis*-carbon being utilized by zooplankton may be a common phenomenon in Lake Taihu and other lakes with *Microcystis* blooms. However, the mechanism of *Microcystis* carbon being utilized by other aquatic creatures was not clear. Moreover, the contribution rate of *Microcystis* detritus and the attached bacteria to other aquatic organisms need to be further studied.

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Stratification and its determining factors of water physicochemical variables in large, shallow Lake Taihu.

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A nine-day observation on the process of vertical stratification of physicochemical variables was taken in Taihu, a large shallow lake of China. Frequent stratification processes occurred during the 9 days. But the stratifying state was unstable, and normally last less than 1 day. The main factors causing stratification were water temperature and its diel variation, cyanobacterial bloom scum and wind-induced wave disturbance. The vertical difference of water temperature may reach 3.94 °C, which was mainly influenced by diel variation of air temperature and solar radiation. And the stratification of water temperature was the basic factor causing the stratification of dissolved oxygen, electric conductivity, and pH. Cyanobacterial bloom scum could cause the strongest stratification, which could cause vertical difference of 8.67 mg/L of dissolved oxygen, 48 μC/cm of electric conductivity, 1.49 of pH, 9.1 μg/L of chlorophyll-*a* and 26.5 NTU of turbidity. Besides turbidity, stratification of physicochemical became weaker with increase of wind speed. No stratification happened during strong wind period in which of wind speed over 6 m/s, while it often happened during weak condition in which of wind speed less than 2 m/s. The study indicated that, stratification processes could frequently short-term occurred in the large shallow lakes. And the stratification may have potential influence on the processes of biological activities and exchange on air-water interface and water-sediment interface in large shallow lakes.

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Vertical Stratification of Water Nutrients during Algal Accumulation in Large, Shallow Lake Taihu

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An observation on stratification of nutrients in overlying water from July 26th to 31th was taken in Lake Taihu. When the wind speed slowed down and the wind direction changed to west on July 27th, which is helpful for algal accumulation in the east bank of Meiliang Bay, a strong bloom came into being at the Taihu Lake Laboratory for Ecosystem Research (TLLER) on July 28th and the value of chlorophyll-*a* (chl-*a*) in overlying water reached a peak on 29th. Total phosphorus (TP) and total nitrogen (TN) increased in a major trend during the observation as well as the variation of chl-*a* and dissolved oxygen (DO). While dissolved total phosphorus (DTP) and dissolved total nitrogen (DTN) decreased just opposite to the changes of chl-*a* and DO. TP and TN in surface water were apparently more than those in middle or deep water especially when the bloom was breaking up. They may be contributed by algae. The stratifications of DTP and DTN showed differently with a significant high value in surface water firstly and then a potential increment in deep water after the algal accumulation. Particularly, the value of PO_4^{3-}, the key exchange form of TP on water-sediment interface, had an evident increase in deep water even exceeded that in surface and middle water. It is considered from the release of sediment.