Journal of Risk Analysis and Crisis Response, 2024, 14(1), 70-79
https://jracr.com/
ISSN Print: 2210-8491
ISSN Online: 2210-8505

Article

Seasonal Variation of Water Quality of Taiping Lake in Eastern China

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Received: November 28, 2023; Received in revised form: February 8, 2024; Accepted: February 15, 2024; Available online: March 31, 2024

Abstract: Lakes and reservoirs are an important sources of drinking water for human life. However, numerous water quality indexes show seasonal fluctuation under different climatic conditions. We conducted a one-year investigation of Taiping Lake in year 2022 to construct relationship between water quality parameters and water quality. High water temperature promotes the growth of algae, and the existence of N species could provide the essential nutrient substance for the growing of algae. Under the irradiation of sunlight, algae will consume carbon dioxide through photosynthesis and release oxygen which can raise oxygen levels in the water. However, the rapid growth of algae could influence the acid-base balance in water through the consumption of carbon dioxide; thus, resulting in the increasing of pH values. These pH changes may pose a threat to drinking water.

Keywords: Seasonal Variation; Water Quality; Taiping Lake; Algae; pH Values; Oxygen

1. Introduction

Lakes and reservoirs are an important source of drinking water for human life [1]. Water quality indices are important references for measuring drinking water quality. However, numerous water quality indexes show seasonal fluctuation, which indicates the variation of water quality under different climatic conditions [2]. Currently, global warming is one of the major environmental problems that challenges the further development of human society [3–5]. Considering the continuous effect of global warming, thermal cycling of lakes and reservoirs has been greatly influenced, resulting in increased variation of physicochemical processes [6,7].

Over the past decades, atmospheric conditions have changed worldwide. These changes have affected the physicochemical properties of lakes and reservoirs [8,9]. According to previous works, multiple water quality indices show wide seasonal fluctuations especially in summer [10,11]. Enhanced algal growth is seen as a result of high temperatures, releasing oxygen through photosynthesis, increasing the content of oxygen in water, further promoting the growth of algae. Therefore, lakes and reservoirs can face serious environment pollution. Exploring the mechanisms controlling seasonal fluctuations of lakes and reservoirs is of great importance for the quality of drinking water and its safety. Rarely has research in this arena adopted systematic or holistic approaches.

DOI: https://doi.org/10.54560/jracr.v14i1.437

We conducted a one-year water quality survey of Taiping Lake. Taiping Lake is an artificial reservoir in Huangshan city in Eastern China and one of the most important sources of local drinking water. Few studies have been reported about Taiping Lake and we lack a comprehensive understanding of the artificial reservoir and its seasonal fluctuations concerning water quality. The results of this one-year study should contribute to this understanding and provide information that can be used to assess the seasonal fluctuations in other artificial lakes.

2. Materials and Methods

Water quality surveys include the collection, preservation, and measurement of water chemistry and algal conditions. The sampling period of the program includes four seasons throughout the year and samples three sites (referred to as sites A, B and C) (Fig. 1 arises from Ministry of Natural Resources of China with map drawing approval number of No. GS (2022)4308). The water samples were collected from the three sites using 5 L containers (i.e., glass, plastic, and brown bottles). The containers were kept at 4 ^{o}C until laboratory analyses could be completed. Water temperature, pH, and dissolved oxygen (DO) were measured in situ (pH: PHBJ-260F, DO: JPB-607A, Water temperature: thermometer) [12]. Total phosphorus (TP), total nitrogen (TN), ammonia nitrogen was measured using UVmini-1280 [13]. Nitrate nitrogen was monitored by CIC-D120 [14]. Chlorophyll was investigated via UVmini-1280 based on HJ 897-2017. Algae was monitored based on SC/T9402-2010 and SL219-98 regulation [15–17].

Pearson's correlation coefficient is a metric used to describe relationships among variables. This method uses the covariance matrix of data to evaluate the strength of the relationship between two vectors. Normally, the Pearson's correlation coefficient between two variables, β_i and β_j, can be calculated as according to previous work [2].

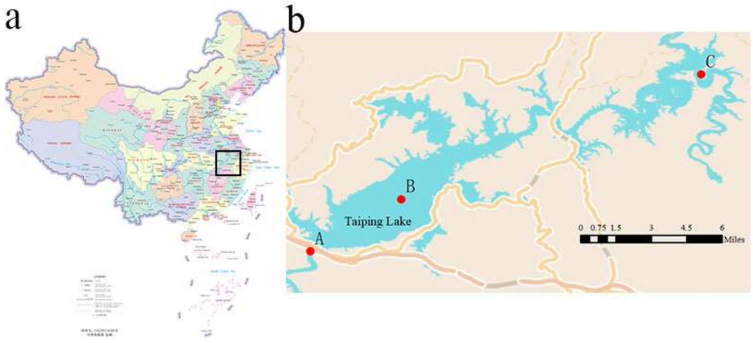


Figure 1. Sampling point of the Taiping Lake.

3. Results

Water temperature and pH are two of the primary water quality parameters for lakes and reservoirs. Seasonal variations of pH and water temperature for sites A, B and C in Taiping Lake are shown in Fig. 2. Sites A, B and C exhibit similar temporal patterns for both pH and temperature, demonstrating the weak seasonal fluctuations of these parameters. Values of pH fluctuate displaying higher pH values in summer and relatively lower values in spring, autumn and winter. Conversely, water temperature increases from February to August, reaching the peak temperature in August. Then, the water temperature decreases after August in conjunction with the gradually cooling weather. Based on these results, it can be concluded that the water temperature is closely correlated with climatic conditions in different seasons. Similarly, pH shows a strong correlation with temperature.

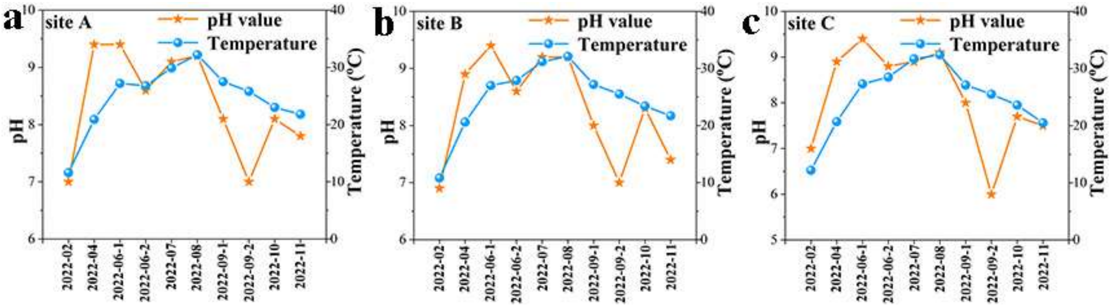


Figure 2. Seasonal variations of pH and water temperature, (a) site A; (b) site B; (c) site C in Taiping Lake.

Total phosphorus (TP) is the combination of various phosphorus species and is an important water quality parameter for investigating eutrophication of lakes and reservoirs [18]. Generally, TP is determined by combining the various forms of phosphorus converted to orthophosphate [19]. TP measurements at sites A, B and C in Taiping Lake are shown in Fig. 3. TP maintains a low concentration at sites A, B and C throughout the year. According to the environmental functions and protection objectives of surface water areas, it is divided into five categories according to the level of functions (GB 3838-2002) [20]. TP concentrations meet the criterion of Chinese surface water quality standards (Ⅱ) shown in Table 1.

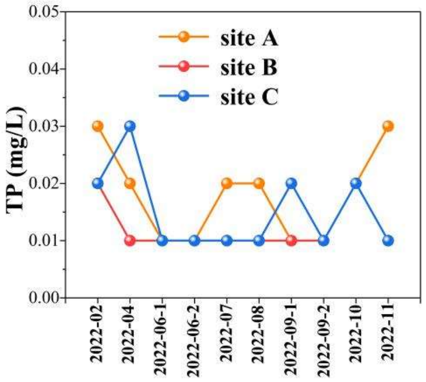


Figure 3. Seasonal variations of TP for sites A, B and C in Taiping Lake.

Table 1. TP standard of for lakes and reservoirs based on GB 3838-2002.

Index	I	Ⅱ	III	IV	V
TP (mg/L)	0.01	0.025	0.05	0.1	0.2

Like TP, total nitrogen (TN) is also an important water quality parameter for investigating eutrophication of lakes and reservoirs [21]. TN represents the combination of various organic and inorganic nitrogen species into a single measure [22]. As seen in Fig. 4, TN values at sites A, B and C display similar patterns with a continuous decline throughout the year from highs in April to lows in the September to November (except for site A). According to the results, the highest concentrations of TN were observed in April.

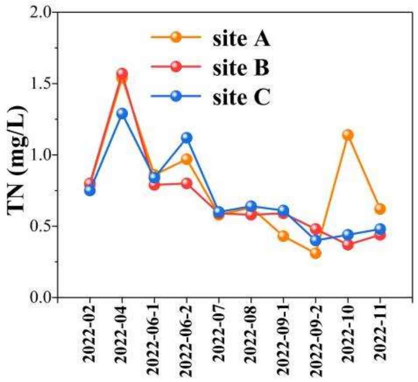


Figure 4. Seasonal variations of TN for sites A, B and C in Taiping Lake.

Ammonia nitrogen is an important constituent of TN, which represents the form of free ammonia (NH_3) and ammonium ions (NH_4^+) [23]. Increased concentrations of ammonia nitrogen in water bodies can often lead to the eutrophication of lakes and reservoirs [24]. Additionally, ammonia nitrogen can pose great risk to aquatic organisms by promoting algal growth and subsequent consumption of oxygen by microbial respiration, resulting in death of aquatic life and severe water deterioration [25]. In Fig. 5, similar seasonal patterns can be observed for ammonia nitrogen as seen for TN in Fig. 4. Ammonia nitrogen concentrations for sites A, B and C exhibit similar patterns with a continuous decline throughout the year. Concentrations of ammonia nitrogen reach the highest levels in April. Increased NH_4^+ could flow into the Taiping Lake by overland runoff during rainfall events and result in increased the concentration of ammonia nitrogen concentrations in the lake [26].

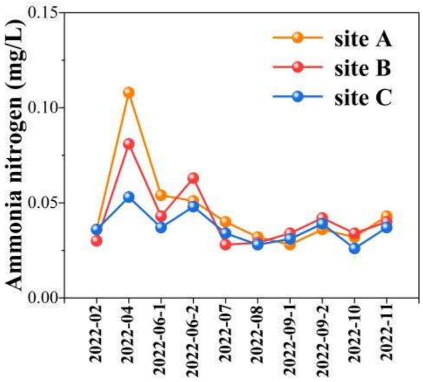


Figure 5. Seasonal variations of ammonia nitrogen at sites A, B and C in Taiping Lake.

Nitrate nitrogen is another significant form of nitrogen and refers to the nitrogen contained as nitrate [27]. Nitrate nitrogen can be generated by the decomposition of organic matter in water and soil into ammonium salts and with further oxidizing can be an indicator of contamination [28]. In Fig. 6, the concentration of nitrate nitrogen increases and reaches the peak value in April, which shows similar trend in comparison with the results of TN and ammonia nitrogen. The content of nitrate nitrogen reduces with continuous increasing of water temperature. Nitrate nitrogen almost disappears and, generally, could not be detected in high temperature waters.

Dissolved oxygen (DO) is the amount of oxygen dissolved in water, which exists as molecular state. DO is one of the important indicators of water quality [29]. High levels of DO favor the decomposition of water pollutants and purifies the water body promptly. As can be seen in Fig. 7 a-c, DO concentrations at sites A, B and C of Taiping Lake show similar trend. DO displays a higher concentration in February, March and April which shows a lower level in August, September and October but still maintain a high DO content. Water temperature, consumption of aerobic organic matter by aerobiont and reoxygenation by photosynthesis of phytoplankton are mainly responsible for the greatly fluctuation of DO [30].

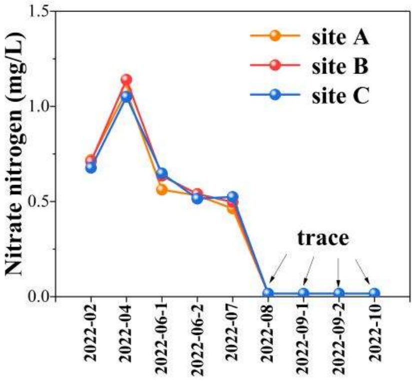


Figure 6. Seasonal variations of nitrate nitrogen at sites A, B and C in Taiping Lake.

Chlorophyll (Chl) is an important indicator for estimating phytoplankton biomass [31]. The primary productivity and eutrophication level of water can be measured by monitoring the chlorophyll content of phytoplankton in water. According to results shown in Fig. 7 a-c, Chl concentrations maintain a high level in summer during periods with high water temperatures, especially in July. Meanwhile, the variational tendency of Chl is consistent with DO. Based on previous reports and the present results [32], it can be concluded that Chl is highly correlated with DO concentrations. Existence of phytoplankton in water under the irradiation of intense light could generate oxygen via photosynthesis, which will increase the content of DO in water and maintain a high level in mega thermal climate.

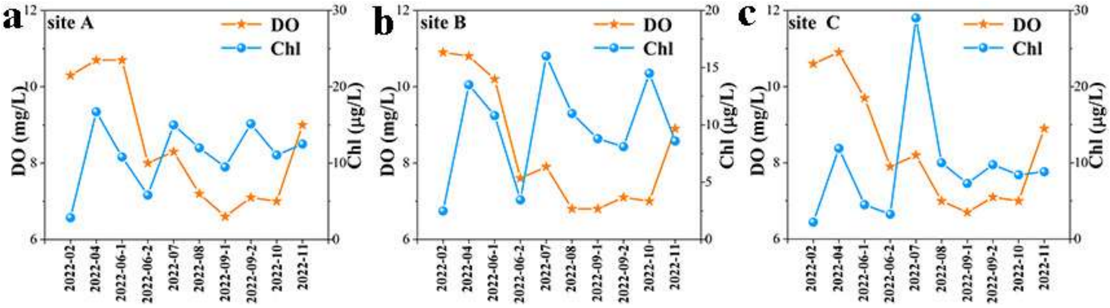
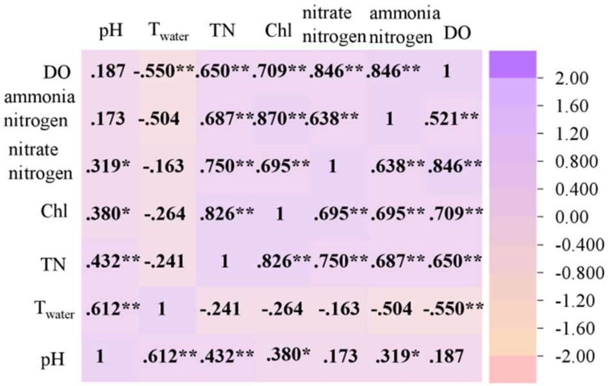


Figure 7. Seasonal variations of DO and Chl, (a) site A; (b) site B; (c) site C in Taiping Lake.

In order to explore the correlation between different water quality factors, the Pearson correlation index [2] was calculated and the results are shown in Fig. 8. Several inferences can be drawn: 1) pH is closely correlated with water temperature, TN, ammonia nitrogen, Chl; 2) Chl links tight with TN, ammonia nitrogen, nitrate nitrogen and DO; 3) DO correlates strongly with water temperature, TN, ammonia nitrogen, Chl and nitrate nitrogen. Meanwhile, existence of N species could provide the essential nutrient substance for the growing of phytoplankton. Under the irradiation of sunlight, phytoplankton could generate oxygen via photosynthesis. Simultaneously, the rapid growth of phytoplankton may break the acid-base balance in water; thus, changing the pH values.



	pH	T_{water}	TN	Chl	nitrate nitrogen	ammonia nitrogen	DO
DO	.187	-.550**	.650**	.709**	.846**	.846**	1
ammonia nitrogen	.173	-.504	.687**	.870**	.638**	1	.521**
nitrate nitrogen	.319*	-.163	.750**	.695**	1	.638**	.846**
Chl	.380*	-.264	.826**	1	.695**	.695**	.709**
TN	.432**	-.241	1	.826**	.750**	.687**	.650**
T_{water}	.612**	1	-.241	-.264	-.163	-.504	-.550**
pH	1	.612**	.432**	.380*	.173	.319*	.187

Figure 8. Pearson correlation index (** Significant correlation at 0.01 level* Significant correlation at 0.05 level).

To further investigate the seasonal variation of the water environment and the correlation between various water quality factors, phytoplankton community composition was monitored. In Table 2 and Fig. 9, the variety of algae varies throughout the year. For sites A and C, Bacillariophyta, Chlorophyta, and Cyanophyta are the main algae seen throughout the year while Bacillariophyta occupies the highest proportion among all the algae. However, site B is different from sites A and C, with Bacillariophyta, Chlorophyta, Cyanophyta and Pyrroptata being the main algae observed. Generally, algal growth is closely related to water conditions and often reveals the quality of water [4]. For sites A and C, Cyanophyta is the dominant alga during periods of in the lower water temperatures, while Bacillariophyta and Chlorophyta are dominant during periods of higher water temperatures, suggesting that higher water temperatures favor the growth of Bacillariophyta and Chlorophyta. For site B, Chlorophyta and Pyrroptata, as well as a variety of Bacillariophyta, are the main algae. It can be concluded that the differences between algal species indicates different water environments.

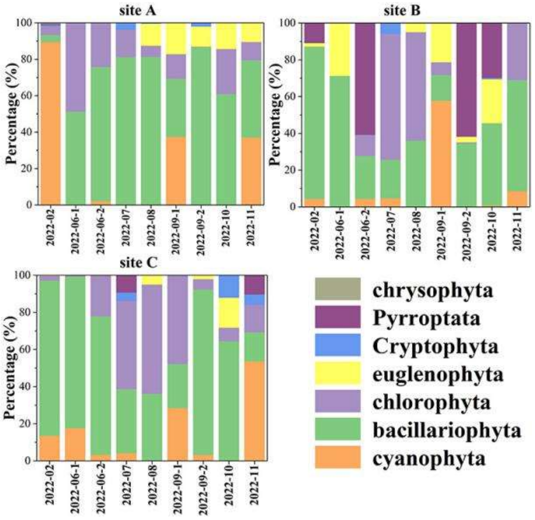


Figure 9. Seasonal variations of alga, (a) site A; (b) site B; (c) site C in Taiping Lake.

Changes in algal species composition appears closely connected to the water environment and often reveals the quality of water. Dominant algal species from sites A, B and C in Taiping Lake are shown and compared by degree of dominance in Table 2. As can be seen, a diversified algal community can be detected in different seasons across the sites. Under high water temperature conditions, Bacillariophyta, Pyrroptata, and Chlorophyta are the dominant species while Cyanophyta are the major algae during periods of lower water temperatures.

Table 2. Dominant forms of algae at sites A, B and C in Taiping Lake.

Date	Site	Species
February	A	Anabaena
	B	Lyngbya
	C	Melosira; Fragilaria; Euglena acus
June-1	A	Melosira; Melosira granulata; Fragilaria capucina; Nitzschia
	B	Fragilaria capucina; Nitzschia
	C	Fragilaria capucina
June-2	A	Fragilaria; Melosira granulata; Navicula; Cocconeis; Oocystis
	B	Fragilaria; Cocconeis; Cosmarium
	C	Fragilaria; Cocconeis; Oocystis; Microcystis
July	A	Oocystis; Cosmarium; Cyclotella; Cryptomonas ovata
	B	Nitzschia; Navicula; Oocystis; Cryptomonas ovata
	C	Cosmarium; Cryptomonas ovata
August	A	Euglena acus; Cocconeis; Aulacoseira granulata
	B	Navicula; Pediastrum simplex; Peridinium; Trachelomonas
	C	Pediastrum simplex
September-1	A	Cyclotella; Euglena
	B	Cyclotella; Lyngbya
	C	Cyclotella; Lyngbya; Oocystis
September-2	A	Melosira; Trachelomonas; Cocconeis placentula
	B	Melosira; Euglena acus; Peridinium
	C	Aulacoseira granulata
October	A	Navicula; Trachelomonas; Cocconeis placentula
	B	Navicula; Euglena acus; Peridinium; Euglena
	C	Cocconeis; Trachelomonas; Cocconeis placentula
November	A	Anabaena; Nitzschia; Cyclotella; Euglena
	B	Cosmarium; Pediastrum simplex
	C	Anabaena; Navicula; Cyclotella

Based on the above data, a reasonable pattern of annual water quality parameters for Taiping Lake has been demonstrated. In spring and winter with lower water temperatures, Cyanophyta can multiply and become the dominant algal species in the Taiping Lake. Meanwhile, the water quality indices demonstrate compliance with the criterion of Chinese surface water quality standards (Ⅱ , GB 3838-2002) [20] indicating better water quality. However, Bacillariophyta, Pyrroptata, and Chlorophyta will be the dominant species under high water temperature conditions, contributing to poorer water quality. Higher water temperatures promote the growth of phytoplankton. Meanwhile, the existence of excess N species could provide the essential nutrient requirement for the growth of phytoplankton. Under increased sunlight, algae will consume carbon dioxide to drive photosynthesis and the subsequent release of oxygen, increasing oxygen levels in the water. Simultaneously, the rapid growth of algae may influence the acid-base balance in water by consuming carbon dioxide and resulting in an increase of pH values.

4. Conclusions

In summary, a plausible picture of the water quality patterns in Lake Taiping was constructed based on the seasonal variation of water quality parameters. The growth of algae is closely related to water temperature and the composition of the algae community, which could drive the differences in water quality. In lower water temperature conditions, Cyanophyta could multiply and become the dominant algal species. However, Bacillariophyta, Pyrroptata, and Chlorophyta are the dominant species under higher water temperatures, perhaps, contributing to poorer water quality. High water temperatures promote the growth of algae. Meanwhile, existence of N species could provide the essential nutrient necessary for enhanced algal growth. Under increased sunlight, algae will consume carbon dioxide to drive photosynthesis and release oxygen, raising oxygen levels in the water. Simultaneously, the rapid growth of algae may alter the acid-base balance in water by consuming carbon dioxide resulting in increased pH values.

Contributions: Conceptualization, Bo-lun Wang; methodology, Li-ping Qian; software, Yi Luo; validation, Yi Luo; formal analysis, Ran Chen; investigation, Bo-lun Wang; resources, Bo-lun Wang; data curation, Li-ping Qian; writing—original draft preparation, Ran Chen; writing—review and editing, Ming-hai Ma; visualization, Ming-hai Ma; supervision, Ming-hai Ma; project administration, Li-ping Qian; funding acquisition, Li-ping Qian. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by talent program of Huangshan University (2021xkjq007), project commissioned by Huangshan ecological environmental law enforcement monitoring station (HJACG2021C131A), Key project of Scientific Research in Anhui Province (2022AH040266).

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

References

[1] Argüelles, R.; Toledo, M.; Martin, M.A. Study of the Tagus River and Entrapments reservoir ecosystem around the Trillo nuclear power plant using chemometric analysis: Influence on water, sediments, algae and fish. Chemosphere, **2021**, 29, 130532. DOI: https://doi.org/10.1016/j.chemosphere.2021.130532.

[2] Hou, P.F.; Chang, F.Q.; Duan, L.Z.; Zhang, Y.; Zhang, H.C. Seasonal variation and spatial heterogeneity of water quality parameters in Lake Chenghai in southwestern China. Water, **2022**, 14, 1640. DOI: https://doi.org/10.3390/w14101640.

[3] Lu, Y.; Wang, R.; Zhang, Y.; Su, H.; Wang, P.; Jenkins, A.; Ferrier, R.C.; Bailey, M.; Squire, G. Ecosystem health towards sustainability. Ecosystem Health and Sustainability, **2015**, 1, 1-15. DOI: https://doi.org/10.1890/ehs14-0013.1.

[4] Xue, L.Y.; Hu, J.J.; Wang, Z.L.; Pei, G.F.; Chen, L.G. Assessing risks of algal blooms in water transfer based on algal growth potential. *Environmental Monitoring and Assessment*, **2023,** *195*, 871. DOI: https://doi.org/10.1007/s10661-023-11514-0.

[5] Zhang, J.T.; You, Q.L.; Ren, G.Y.; Ullah, S. Substantial increase in human-perceived heatwaves in eastern China in a warmer future. *Atmospheric Research*, **2023**, *283*, 106554. DOI: https://doi.org/10.1006/j.atmosres.2022.106554.

[6] Zhang, Y.; Wu, Z.; Liu, M.; He, J.; Shi, K.; Zhou, Y.; Wang, M.; Liu, X. Dissolved oxygen stratification and response to thermal structure and long-term climate change in a large and deep subtropical reservoir (Lake Qiandaohu, China). *Water Research*, **2015**, *75*, 249-258. DOI: https://doi.org/10.1016/j.atmosres.2022.106554.

[7] Alexakis, D.; Kagalou, I.; Tsakiris, G. Assessment of pressures and impacts on surface water bodies of the Mediterranean. Case study: Pamvotis Lake, Greece. *Environmental Earth Sciences*, **2013**, *70*, 687-698. DOI: https://doi.org/10.1007/s12665-012-2152-7.

[8] Zou, R.; Zhang, X.; Liu, Y.; Chen, X.; Zhao, L.; Zhu, X.; He, B.; Guo, H. Uncertainty-based analysis on water quality response to water diversions for Lake Chenghai: A multiple-pattern inverse modeling approach. *Journal of Hydrol*ogy, **2014**, *514*, 1-14. DOI: https://doi.org/10.1016/j.jhydrol.2014.03.069.

[9] Liu, X.; Lu, X.; Chen, Y. The effects of temperature and nutrient ratios on Microcystis blooms in Lake Taihu, China: An 11-year investigation. *Harmful Algae*, **2011**, *10*, 337-343. DOI: https://doi.org/10.1016/j.hal.2010.12.002.

[10] Kirillin, G.; Shatwell, T. Generalized scaling of seasonal thermal stratification in lakes. *Earth-Science Reviews*, **2016**, *161*, 179-190. DOI: https://doi.org/10.1016/j.earscirev.2016.08.008.

[11] Liu, Y.; Wang, Y.; Sheng, H.; Dong, F.; Zou, R.; Zhao, L.; Guo, H.; Zhu, X.; He, B. Quantitative evaluation of lake eutrophication responses under alternative water diversion scenarios: A water quality modeling based statistical analysis approach. *Science of Total Environment*, **2014**, *468-469*, 219-227. DOI: https://doi.org/10.1016/j.scitotenv.2013.08.054.

[12] Mădălina, P.; Breaban, I.G. Water quality index-An instrument for water resources management. *Aerul şi Apa: Componente ale Mediului*, **2014**, *1*, 391-398. DOI: https://doi.org/10.15407/mining10.03.077.

[13] Wang, L.; Li, D.P.; Li, X.Y.; Liang, H.; Yue, W.; Wang, L.Z.; Pan, Y.; Huang, Y. Recirculation of activated sludge for coagulant synthesis under hydrothermal conditions. *Environment Science and Pollution Research*, **2020**, *29*, 66519-66535. DOI: https://doi.org/10.1007/s11356-022-20490-w.

[14] Wu, D.; Feng, R.F.; Xu, C.Y.; Sui, P.F.; Zhang, J.J.; Fu, X.Z.; Luo, J.L. Regulating the electron localization of metallic bismuth for boosting CO_2 electroreduction. *Nano-Micro Letters*, **2022**, *14*, 38. DOI: https://doi.org/10.1007/s40820-021-00772-7.

[15] Jin, X.C.; Chen, X.Q.; Gao, L.M.; Chen, X.D.; Ge, J.; Wei, F.Y.; Lu, H.S.; Wu, Y.F.; Cui, J.H.; Yuan, M.D. A self-organizing map approach to the analysis of lake DOM fluorescence for differentiation of organic matter sources. *Environmental Science and Pollution Research*, **2023**, *30*, 75788-75798. DOI: https://doi.org/ 10.1007/s11356-023-27860-y.

[16] Xu, D.; Xia, Y.; Li, Z.X.; Gu, Y.G.; Lou, C.H.; Wang, H.; Han, J.L. The influence of flow rates and water depth gradients on the growth process of submerged macrophytes and the biomass composition of the phytoplankton assemblage in eutrophic water: an analysis based on submerged macrophytes photosynthesis parameters. *Environmental Science and Pollution Research*, **2020**, *27*, 31477-31488. DOI: https://doi.org/10.1007/s11356-020-09404-w.

[17] Zhao, H.X.; Duan, X.J.; Becky, S.; You, B.S.; Jiang, X.W. Spatial correlations between urbanization and river water pollution in the heavily polluted area of Taihu Lake Basin, China. *Journal of Geographical Sciences*, **2013**, *23*, 735-752. DOI: https://doi.org/10.1007/s11442-013-1041-7.

[18] Torres, B.F.; Garcia, G.J.; Salcedo, S.J. Numerical modeling of nutrient transport to assess the agricultural impact on the trophic state of reservoirs. *International Soil and Water Conservation Research*, **2023**, *11*, 197-212. DOI: https://doi.org/10.1016/j.iswcr.2022.06.002.

[19] Ran, J.; Xiang, R.; He, J.; Zheng, B.H. Spatiotemporal variation and driving factors of water quality in Yunnan-Guizhou plateau, China. *Journal of Contaminant Hydrology*, **2023**, *254*, 104141. DOI: https://doi.org/10.1016/j.jconhyd.2023.104141.

[20] Shi, Z.T.; Liu, X.Y.; Liu, Y.; Huang, Y.; Peng, H.Y. Catastrophic groundwater pollution in a karst environment: a study of phosphorus sludge waste liquid pollution at the Penshuidong Cave in Yunnan, China. *Environmental Earth Sciences*, **2009**, *9*, 757-763. DOI: https://doi.org/10.1007/s12665-009-0071-z.

[21] Crapart, C.; Flnstad, A.G.; Hessen, D.O.; Vogt, R.D.; Andersen, T. Spatial predictors and temporal forecast of total organic carbon levels in boreal lakes. *Science of Total Environment*, **2023**, *870*, 161676. DOI: https://doi.org/10.1016/j.scitotenv.2023.161676.

[22] Yang, Y.P.; Yin, J.; Ma, Z.H.; Wei, X.D.; Sun, F.B.; Yang, Z. Water and nitrogen regulation effects and system optimization for potato (Solanum tuberosum L.) under film drip irrigation in the dry zone of Ningxia China. *Agronomy Basel*, **2023**, *13*, 308. DOI: https://doi.org/10.3390/agronomy13020308.

[23] Zhang, L.; Xu, E.G.; Li, Y.B.; Liu, H.L.; Vidal-Dorsch, D.E.; Giesy, J.P. Ecological risks posed by ammonia nitrogen (AN) and un-ionized ammonia (NH_3) in seven major river systems of China. *Chemosphere*, **2018**, *202*, 136-144. DOI: https://doi.org/10.1016/j.chemosphere.2018.03.098.

[24] Liu, M.; Li, Y.; Wang, H.Z.; Wang, H.J.; Qiao, R.T.; Jeppesen, E. Ecosystem complexity explains the scale-dependence of ammonia toxicity on macroinvertebrates. *Water Research*, **2022**, *226*, 119266. DOI: https://doi.org/10.1016/j.watres.2022.119266.

[25] Han, Y.; Zhang, M.; Chen, X.F.; Zhai, W.D.; Tan, E.H.; Tang, K. Transcriptomic evidence for microbial carbon and nitrogen cycles in the deoxygenated seawaters of Bohai Sea. *Environmental International*, **2021**, *158*, 106889. DOI: https://doi.org/10.1016/j.envint.2021.106889.

[26] He, Z.G.; Weng, H.X.; Ho, H.C.; Ran, Q.H.; Mao, M.H. Soil erosion and pollutant transport during rainfall-runoff processes. *Water Resources*, **2014**, *41*, 604-611. DOI: https://doi.org/10.1134/s0097807814050170.

[27] Wu, H.; Li, A.J.; Yang, X.; Wang, J.T.; Liu, Y.L.; Zhan, G.Q. The research progress, hotspots, challenges and outlooks of solid-phase denitrification process. *Science of Total Environment*, **2023**, *858*, 159929. DOI: https://doi.org/10.1016/j.scitotenv.2022.159929.

[28] Francois, D.; Youssef, Z. Where to measure water quality? Application to nitrogen pollution in a catchment in France. *Journal of Environmental Management*, **2023**, *326*, 116712. DOI: https://doi.org/10.1016/j.jenvman.2022.116721.

[29] Slathia, N.; Langer, S.; Jasrotia, R. Assessment of water quality and its effect on prawn abundance in three tributaries of Shiwalik rivers: Chenab and Ravi of Jammu, India - A case study. *Applied Water Science*, **2023**, *13*, 77. DOI: https://doi.org/10.1007/s13201-023-01882-w.

[30] Cowan, J.L.W.; Boynton, W.R. Sediment-water oxygen and nutrient exchanges along the longitudinal axis of Chesapeake Bay: Seasonal patterns, controlling factors and ecological significance. *Estuaries*, **1996**, *19*, 562-580. DOI: https://doi.org/10.3354/meps141229.

[31] Pereira, A.C.; Mulligan, C.N.; Veetil, D.P.; Bhat, S. An in-situ geotextile filtration method for suspended solids attenuation and algae suppression in a Canadian eutrophic lake. *Water*, **2023**, *15*, 441. DOI: https://doi.org/10.1016/j.jenvman.2020.111766.

(Executive Editor: Wen-jun Li)