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三峡工程举世瞩目,是长江流域大保护与流域水安全保障的关键性枢纽工程。自 2003 年三峡工程蓄水以来,在防洪、发电、航运、供水等方面产生了巨大的经济、社会及生态环境等综合效益。同时,水库建成后,重庆至宜昌 600 多 km 的自然河道变成了人为控制的大型河流型深水水库,不仅在库区形成了诸如消落带、干一支流往复交融的独特生境,而且由于下泄水流、泥沙、营养盐等水文及生物地球化学要素的时空变化,长江中、下游河床冲淤及演变均出现了一些新特征,江一湖关系也变得比 2003 年之前更加错综复杂,长江流域迎来了"后三峡工程"时代。为了阶段性系统总结、交流这 20 年来三峡水库生态环境效应研究的成果,《湖泊科学》编辑委员会特邀我们组织了本专辑。自 2022 年 4 月发布征稿启示以来,先后收到各类来稿 60 余篇,经过多轮审稿,最终 25 篇得以录用发表。

专辑不少研究成果都数据翔实、针对性强,体现了当下我国三峡工程生态环境效应研究的水平。(1)在水文水资源方面,不仅总结了长江中下游干流及"两湖"的径流泥沙变化,而且研究改进了三峡入库洪水概率预报方法,尤其是针对工程运用后三峡水库泥沙淤积及长江中下游河床调整、河道冲刷、航道水深资源等方面更是有多篇论文刊发。(2)在水环境水生态方面,对水动力、水沙变化引起的生态环境效应进行了系统的归纳和分析,并对水库消落带土壤一植物一微生物作用下的氮循环关键过程研究进行了系统回顾;研究认为,目前的水库富营养化及潜在的水华风险主要在支流,但是对干、支流浮游植物生长增殖的因果响应也要积极关注。(3)在流域生物多样性保育方面,专辑重点关注了消落区植物群落演变及优势植物适应策略、后三峡工程时代的鄱阳湖湿地植被生产力演变以及水库库尾江段产漂流性卵鱼类早期资源等。(4)在流域水安全方面,有论文针对库湾水一气界面热交换过程及水体稳定性进行了分析;我们高兴的发现,模拟分析揭示了三峡水库成库以来的气候效应主要集中在局地和近地层,而不是区域性的,这一研究成果无疑具有积极和深远的意义。(5)作为我国最大的水库,其温室气体排放及对"碳中和""碳达峰"的贡献研究,无疑也引起了国内外学者的积极和长期关注,专辑中对水库 CO_2、CH_4通量监测分析研究进行了系统回顾与展望,这也将是未来三峡水库的研究热点之一。

这是《湖泊科学》近 10 年来策划出版的第 4 个专辑。专辑不在多而在于精,未来我们还将持续关注三峡水库,长期跟踪、重点报道后三峡工程时代长江流域水资源、水生态、水环境、水安全方面的研究成果,更好地为长江大保护和我国水生态文明建设服务。

Editorial

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The Three Gorges Project is a key pivotal hydro-project in the Yangtze River Basin for the protection and security of water resources, which has been attracting worldwide attention over the past decades. Since the impoundment of the Three Gorges Reservoir in 2003, the project has created great economic, social, and ecological benefits in terms of flood control, hydropower generation, navigation, and water supply. Meanwhile, the reservoir formation has drastically transformed the 600 km natural river reach of Yangtze River, from Chongqing to Yichang, to a large river-valley dammed reservoir with deep water regulated by the dam. Such has created unique landscapes and habitats within the reservoir, e.g., drawdown area along the shorelines, reciprocal fluctuating backwater water area between tributaries and the main stem, etc. In addition, the regulation of the reservoir discharge also leads to new patterns of spatiotemporal variations of hydrological and biogeochemical parameters, e.g., sediment transport, fluvial equilibrium of downstream channels, nutrient exports, etc. The river-lake relationships in the mid and lower reach of the Yangtze River have been becoming more complex than before 2003. The Yangtze River basin is now in a Post-Three-Gorges-Project era. To summarize the state of research on the ecological and environmental effects caused by the Three Gorges Reservoir in the past 20 years, the editorial board of the *Journal of Lake Sciences* invited us to organize this special issue. The call for papers was announced in April 2022. Since then, more than 60 manuscripts have been received, and after extensive reviews, 25 of them were finally accepted for publication. The manuscripts collected in the special issue are informative and relevant, representing the knowledge-of-the-art of the ecological and environmental effects of the giant hydro-project in history. (1) In the area of hydrology and water resources, sediment transport in the mid and lower reaches of the Yangtze River, as well as their exchange with the Lake Dongting and Lake Poyang, were elaborated. The special issue also collected novel methodologies for the flood prediction of the reservoir inflow, in particular, the fluctuation of a downstream riverbed after the operation of the Three Gorges Reservoir, as well as the situation of river scouring and channel depth variation, were extensively discussed. (2) In the area of water environment and aquatic ecology, the special issue systematically addressed the ecological and environmental effects caused by hydrological and hydrodynamic conditions. The important biogeochemical cycles of nitrogen within the soil-plant-microbial interactions in the reservoir drawdown area were also reviewed and discussed profoundly. It highlighted the tributaries of the Yangtze River in the reservoir, exhibiting the trends of eutrophication, had potential risks of algal blooms. However, the causal chain of phytoplankton growth in the main stem and tributaries should also be taken into further attention. (3) In the area of watershed biodiversity conservation, the special issue collected manuscripts on the evolution of vegetation communities and adaptive strategies of dominant populations in the drawdown area. The evolution of vegetation productivity in the wetland of Lake Poyang was discussed. The research on drifting egg-producing fish populations was also included in the special issue. (4) In the watershed water security, manuscripts in the special issue discussed the air-water heat transfer process and thermal stability of the water column in the reservoir. Rather than regionally, we were delighted to find that modeling analysis revealed that the potential climatic effect caused by the project were mainly limited to the local scale or near-surface layer. Undoubtedly, this result seemed to be positive with considerable significance. (5) As China's largest reservoir, greenhouse emissions from the reservoir have been the concern of academic communities, stakeholders, and policymakers, particularly about its potential contribution to China's road to carbon neutrality. The special issue collected recent advances and outlooks on field monitoring and analysis of CO_2 and CH_4 fluxes in the reservoir. We believed that this would be a research hot spot shortly.

This is the fourth special issue in the *Journal of Lake Sciences* over the past decade. It is not the number of manuscripts that counts but the quality of the research. In the future, we will continue to focus on the Three Gorges Reservoir, and report on the state of the research on hydrology, ecology, and environment and watershed water security in the Yangtze River Basin in the Post-Three-Gorges-Project era. These efforts will better serve the Great Protection Strategy of the Yangtze River and ecological civilization in China.