湖泊流域动态

本期导读

- **Science**：形成一片水华需要一个(微生物)聚落
- **Nature Geoscience**：1900-2060年期间水库 CO_2 及 CH_4 排放估算及气候效应
- **PNAS**：从生态监测数据估算功能多样性和物种特性
- **Nature Reviews Earth & Environment**：取水/调水改变了氮循环
- 水体温室气体排放对温度的响应因水生植物优势种而异

2022 年　　第 4 期(总第 32 期)

10-12月

中国科学院南京地理与湖泊研究所
图书馆，湖泊与环境国家重点实验室
中国科学院武汉文献情报中心
江苏省海洋湖沼学会
联合编制

目录

摘要精选

科学视点

业界动态

新文速递

Reservoir CO_2 and CH_4 emissions and their climate impact over the period 1900–2060

Cynthia Soued; John A. Harrison; Sara Mercier-Blais;等

Reservoirs are essential for human populations, but their global carbon footprint is substantial (0.73–2.41 $PgCO_2$-equivalent yr^{-1}). Yet the temporal evolution of reservoir carbon emissions and their contribution to anthropogenic radiative forcing remains unresolved. Here we quantify the long-term historical and future evolution (1900–2060) of cumulative global reservoir area, carbon dioxide and methane emissions and the resulting radiative forcing. We show that global reservoir carbon emissions peaked in 1987 (4.4 $TmolC\ yr^{-1}$) and have been declining since, due largely to decreasing carbon dioxide emissions as reservoirs age. However, reservoir-induced radiative forcing continues to rise due to ongoing increases in reservoir methane emissions, which accounted for 5.2% of global anthropogenic methane emissions in 2020. We estimate that, in the future, methane ebullition and degassing flux will make up >75% of the reservoir-induced radiative forcing, making these flux pathways key targets for improved understanding and mitigation.

（来源: Nature Geoscience 出版年: 2022, **DOI:** 10.1038/s41561-022-01004-2）

Reconciling disagreement on global river flood changes in a warming climate

Zhang, Shulei; Zhou, Liming; Zhang, Lu; 等

An intensified hydrological cycle with global warming is expected to increase the intensity and frequency of extreme precipitation events. However, whether and to what extent the enhanced extreme precipitation translates into changes in river floods remains controversial. Here we demonstrate that previously reported unapparent or even negative responses of river flood discharge (defined as annual maximum discharge) to extreme precipitation increases are largely caused by mixing the signals of floods with different generating mechanisms. Stratifying by flood type, we show a positive response of rainstorm-induced floods to extreme precipitation increases. However, this response is almost entirely offset by concurrent decreases in snow-related floods, leading to an overall unapparent change in total global floods in both historical observations and future climate projections. Our findings highlight an increasing rainstorm-induced flood risk under warming and the importance of distinguishing flood-generating mechanisms in assessing flood changes and associated social-economic and environmental risks. Climate change is expected to intensify the hydrological cycle, but how this translates into changes in river floods is not clear. Here, the authors show that changes in river flood discharge differ between flood types, with increases in rainfall-induced floods and decreases in snow-related floods.

（来源：Nature Climate Change 出版年: 2022 **DOI:**10.1038/s41558-022-01539-7）

Seasonal increase of methane emissions linked to warming in Siberian tundra

Roessger, Norman; Sachs, Torsten; Wille, Christian; 等

While increasing methane emissions from thawing permafrost are anticipated to be a major climate feedback, no observational evidence for such an increase has previously been documented in the literature. Here we report a trend of increasing methane emissions for the early summer months of June and July at a permafrost site in the Lena River Delta, on the basis of the longest set of eddy covariance methane flux data in the Arctic. Along with a strong air temperature rise of 0.3 +/- 0.1 degrees C yr(-1) in June, which corresponds to an earlier warming of 11 d, the methane emissions in June and July have increased by roughly 1.9 +/- 0.7% yr(-1) since 2004. Although the tundra's maximum source strength in August has not yet changed, this increase in early summer methane emissions shows that atmospheric warming has begun to considerably affect the methane flux dynamics of permafrost-affected ecosystems in the Arctic. The authors provide long-term observational evidence of an increasing trend of early summer methane emissions from a permafrost site in the Lena River Delta linked to atmospheric warming. This observed trend constitutes a major development given the thick and cold permafrost in the study area.

（来源：Nature Climate Change 卷:12 期: 11 出版年: 2022 **DOI:**10.1038/s41558-022-01512-4）

It takes a (microbial) village to make an algal bloom

Pennisi, Elizabeth

Every summer, surges of toxic green muck plague lakes worldwide, sickening hikers who fail to purify drinking water, closing favorite swimming holes, and killing fish. The most feared—and studied—cause of these freshwater “algal” blooms is a genus of cyanobacterium called Microcystis. Its explosive summer growth is thought to be spurred by rising levels of phosphorus, nitrogen, and other nutrients, perhaps from fertilizer run off or other pollution sources. But new research, driven by advances in DNA sequencing, suggests other types of microbes also play key roles in these massive overgrowths.

According to one study, viruses killing off a main competitor of toxic Microcystis may help pave the way for blooms; another indicates nitrogen fixation by other bacteria may provide the needed boost. The results suggest that reducing nutrients may not be enough to stop these slimy explosions, some scientists say. That doesn’t mean curbing pollution is unimportant, they stress, but ecological factors must be considered.

“Interspecies biological interactions help determine blooms,” says Kevin Johnson, a marine scientist at the Florida Institute of Technology who was not involved in the work. “The more details we understand of bloom creation, the better our knowledge of how they might be prevented or controlled.”

With the warming climate and continuing inflows of pollution, harmful algal blooms are on the rise, becoming more frequent and longer lasting in ever more places across the globe. They are “a pretty wicked problem,” says Ariane Peralta, a microbial ecologist at East Carolina University.

In some lakes, reducing fertilizer runoff at first seemed to thwart blooms—then they came back. Similar plans for bloom-choked Lake Erie might backfire, a team of academic microbiologists and water quality experts funded by the National Science Foundation and other U.S. agencies reported in May. A 2014 bloom there caused such severe shortages of drinking water in the nearby city of Toledo, Ohio, that Canada and the United States have agreed to cut phosphorus going into the lake by 40%.

But a simulation of that strategy, along with an analysis of more than 100 related scientific papers, led the team to conclude that although limiting phosphorus might shrink Lake Erie blooms, they could also grow more toxic: with lower overall growth of microbes, any photosynthetic Microcystis left would receive more sunlight and have more nitrogen available, two conditions that favor an increase in their production of microcystin, a substance that make the blooms toxic. They suggested the lake's nitrogen should also be curtailed.

That simuation hinted that other microbes can indirectly influence the impact of Microcystis. But researchers studying blooms have tended to overlook lakes' many microbial inhabitants, which can include huge numbers of diatoms and other eukaryotes, as well as viruses and various types of bacteria, including smaller than average ones called picocyanobacteria. "Everyone glosses over them as not of managerial concern," says Cody Sheik, a microbial ecologist at the University of Minnesota, Duluth.

Part of the problem has been that it's been difficult to sort out which microbes are doing what in a lake. But Lauren Krausfeldt, a microbiologist at Nova Southeastern University, recently turned to metagenomics, a strategy of sequencing all the DNA in samples of water and other environments, to reconstruct the microbial ecosystem in Florida's Lake Okeechobee. The largest lake in the U.S. southeast, Okeechobee's annual summer blooms have begun to spread down rivers and spill into the Gulf of Mexico and Atlantic Ocean, forcing beaches to close. Between April and September in 2019, the bloom season, Krausfeldt and her colleagues collected multiple water samples at 21 places across the lake. From the fragments of DNA isolated from the samples and sequenced, they pieced together whole genomes belonging to specific species.

The analysis uncovered 30 kinds of cyanobacteria never before detected in the lake, and in some cases new to science, including 13 that could potentially cause blooms, she reported last month at Microbe 2022, the annual meeting of the American Society for Microbiology. "I was surprised at the diversity," Krausfeldt says.

When there was no bloom, the most common organisms were the picocyanobacteria. But as the season progressed, DNA belonging to bacterial viruses, known as phages, that infect the picocyanobacteria rose steeply. Shortly thereafter, the concentration of toxic Microcystis began to skyrocket. An analysis of its genome suggested why: Microcystis contains several antiviral defenses, such as the system that spawned the genome editor CRISPR, that picocyanobacterial lack. In addition, the bloom-forming cyanobacterium has genes that enable it to store nitrogen, a key nutrient, which may provide another competitive advantage over the many lake microbes that did not.

Krausfeldt suspects the phages lie dormant until some unknown environmental cue activates them. Then, after the viruses start slaying more and more picocyanobacteria, newly available nitrogen, phosphorus, and more light fuel a Microcystis bloom, Krausfeldt suggests. The phages' destruction of its hosts' cells may release even more nutrients, playing a key role in enabling algal blooms, she concludes.

Sheik, who says he had not considered phages as a factor in blooms but now wants to explore such viral dynamics, embraces Krausfeldt's ecosystem mindset. "By taking a holistic approach, we can better understand how supporting organisms can help sustain blooms," he says.

Sheik and his colleagues have also added metagenomics, as well as gene activity assessments, to his studies of several small lakes in Minnesota. Those lakes, he reported at the meeting, contain not only some Microcystis, but also another bloom-forming cyanobacterium called Dolichospermum. In 2020 and 2021, when he and colleagues tracked the microbial dynamics in one lake throughout the summer, they saw Dolichospermum become the most abundant microbe only to have its population crash by July. Nitrogen levels in the lake rose and fell in parallel with the microbe, suggesting it was fixing nitrogen and boosting its concentration in the water.

Nitrogen is usually quite scarce in these relatively pristine lakes, yet the nutrient is essential for the production of microcystin. That might explain why Sheik and his colleagues saw levels of Microcystis and its toxin rise after the bloom in nitrogen-fixing Dolichospermum. Microcystis must rely on other members of the freshwater ecosystem to fix nitrogen or to recycle it by breaking down other life forms, Sheik says.

“I’m blown away” by the metagenomic work, says Benjamin Wolfe, a microbiologist at Tufts University, because it can illuminate in great detail the lake’s microbial interactions.

The case of Dolichospermum illustrates how complicated algal blooms can be. The good news, however, is that unlike in Europe, where this bacterium causes toxic blooms, Dolichospermum species in the United States lack the genes to make toxins—at least for now, says Sheik, who plans to keep watching for them in his metagenomic studies.

How the microbial dynamics that drive blooms can be interrupted is still unknown, and the picture is getting more complicated all the time. “We are grappling with understanding what parts of complex microbial communities are changing and what we can change to produce a different outcome,” Peralta says. But she’s optimistic that in time, “we can figure out what levers we can move.”

（来源: Science 出版年: 2022, **DOI:** 10.1126/science.add8038）

Estimation of functional diversity and species traits from ecological monitoring data

Alexey Ryabov；Bernd Blasius；Helmut Hillebrand；等

The twin crises of climate change and biodiversity loss define a strong need for functional diversity monitoring. While the availability of high-quality ecological monitoring data is increasing, the quantification of functional diversity so far requires the identification of species traits, for which data are harder to obtain. However, the traits that are relevant for the ecological function of a species also shape its performance in the environment and hence, should be reflected indirectly in its spatiotemporal distribution. Thus, it may be possible to reconstruct these traits from a sufficiently extensive monitoring dataset. Here, we use diffusion maps, a deterministic and de facto parameter-free analysis method, to reconstruct a proxy representation of the species’ traits directly from monitoring data and use it to estimate functional diversity. We demonstrate this approach with both simulated data and real-world phytoplankton monitoring data from the Baltic Sea. We anticipate that wider application of this approach to existing data could greatly advance the analysis of changes in functional biodiversity.

（来源: PNAS 出版年: 2022,**DOI:** 10.1073/pnas.211815611）

Abstraction alters nitrogen cycling

Zinke, Laura

Despite policy mandates to improve water quality, such as the Clean Water Act, nitrogen pollution continues to degrade freshwater quality throughout the USA. Effective management is hampered by a lack of understanding of water supply processes and their impacts on nitrogen cycling. In particular, groundwater and surface water abstraction temporally store nitrogen in terrestrial systems, but the broader effect of abstraction on nitrogen fluxes is poorly constrained.

Elizabeth Flint, of the British Geological Survey and Lancaster University, and colleagues quantified nitrogen fluxes (as nitrate-N, NO_3–N) related to freshwater abstraction in the contiguous United States using publicly reported data. Annually, 417 kt NO_3 – N was retained via abstraction, equivalent to 57% of annual riverine denitrification. In California, the abstraction flux was almost equal to riverine N export to the ocean. Irrigation and thermoelectric water uses were responsible for most (>70%) of this flux at the national level, but public water supply and self-service domestic water were particularly important contributors in the northeast. The source of the water impacted the flux — groundwater measurements in this study had higher nitrate concentrations than surface water, leading to proportionally outsized abstraction fluxes of NO_3–N. A portion of the abstracted nitrogen leaks back into the environment from water mains, especially in urban areas, or is moved between watersheds (such as in California), further perturbing local nitrogen cycling and contributing to groundwater and downstream nitrogen loads.

These fluxes must be accounted for when quantifying nitrogen budgets relevant to water quality management. This need is especially acute in urban areas, where nitrogen leakage back into the environment is greatest.

（来源: Nature Reviews Earth & Environment 出版年: 2022, **DOI:**10.1038/s43017-022-00352-2）

The unknown biogeochemical impacts of drying rivers and streams

Zimmer, Margaret A.; Burgin, Amy J.; Kaiser, Kendra; 等

Non-perennial rivers and streams - those that periodically cease flowing - are critical components of aquatic systems and comprise over half of global river and stream systems. We argue for coordinated, collaborative, standardized, and open efforts to understand their unique biogeochemical behaviour, which is becoming ever more pressing due to pronounced shifts between wet and dry as the climate changes. Rivers and streams are increasingly drying with climate change and biogeochemical impacts may be important. In this comment the authors discuss the challenges to the biogeochemistry of non-perennial rivers and streams, and what can be done to tackle them.

（来源：Nature Communications 出版年: 2022 卷: 13 期: 1 **DOI:**10.1038/s41467-022-34903-4）

Beaver dams overshadow climate extremes in controlling riparian hydrology and water quality

Dewey, Christian; Fox, Patricia M.; Bouskill, Nicholas J.; 等

Hydrologic extremes dominate chemical exports from riparian zones and dictate water quality in major river systems. Yet, changes in land use and ecosystem services alongside growing climate variability are altering hydrologic extremes and their coupled impacts on riverine water quality. In the western U.S.,

warming temperatures and intensified aridification are increasingly paired with the expanding range of the American beaver-and their dams, which transform hydrologic and biogeochemical cycles in riparian systems. Here, we show that beaver dams overshadow climatic hydrologic extremes in their effects on water residence time and oxygen and nitrogen fluxes in the riparian subsurface. In a mountainous watershed in Colorado, U.S.A., we find that the increase in riparian hydraulic gradients imposed by a beaver dam is 10.7-13.3 times greater than seasonal hydrologic extremes. The massive hydraulic gradient increases hyporheic nitrate removal by 44.2% relative to seasonal extremes alone. A drier, hotter climate in the western U.S. will further expand the range of beavers and magnify their impacts on watershed hydrology and biogeochemistry, illustrating that ecosystem feedbacks to climate change will alter water quality in river systems. Beaver dams increase water flow gradients and nitrate removal far more than seasonal climate extremes. An expanding beaver range is an ecosystem feedback to climate change which could improve water quality.

（来源：Nature Communications 出版年: 2022 卷: 13 期: 1 **DOI:**10.1038/s41467-022-34022-0）

Mapping global lake dynamics reveals the emerging roles of small lakes

Pi, Xuehui; Luo, Qiuqi; Feng, Lian;等

Lakes are important natural resources and carbon gas emitters and are undergoing rapid changes worldwide in response to climate change and human activities. A detailed global characterization of lakes and their long-term dynamics does not exist, which is however crucial for evaluating the associated impacts on water availability and carbon emissions. Here, we map 3.4 million lakes on a global scale, including their explicit maximum extents and probability-weighted area changes over the past four decades. From the beginning period (1984-1999) to the end (2010-2019), the lake area increased across all six continents analyzed, with a net change of +46,278 km(2), and 56% of the expansion was attributed to reservoirs. Interestingly, although small lakes (<1 km(2)) accounted for just 15% of the global lake area, they dominated the variability in total lake size in half of the global inland lake regions. The identified lake area increase over time led to higher lacustrine carbon emissions, mostly attributed to small lakes. Our findings illustrate the emerging roles of small lakes in regulating not only local inland water variability, but also the global trends of surface water extent and carbon emissions.

（来源：Nature Communications 出版年: 2022 卷: 13 期: 1 **DOI:**10.1038/s41467-022-33239-3）

Tidewater-glacier response to supraglacial lake drainage

Stevens, Laura A.; Nettles, Meredith; Davis, James L.;等

The effect of increasing surface melt on annual discharge is unknown for the Greenland Ice Sheet. Here, the authors find that Greenland's largest single-glacier contributor to sea-level rise accommodates basal floods following supraglacial lake-drainage events with limited impact on ice flow. The flow speed of the Greenland Ice Sheet changes dramatically in inland regions when surface meltwater drains to the bed. But ice-sheet discharge to the ocean is dominated by fast-flowing outlet glaciers, where the effect of increasing surface melt on annual discharge is unknown. Observations of a supraglacial lake drainage at Helheim Glacier, and a consequent velocity pulse propagating down-glacier, provide a natural experiment for assessing the impact of changes in injected meltwater, and allow us to interrogate the subglacial hydrological system. We find a highly efficient subglacial drainage system, such that

summertime lake drainage has little net effect on ice discharge. Our results question the validity of common remote-sensing approaches for inferring subglacial conditions, knowledge of which is needed for improved projections of sea-level rise.

（来源：Nature Communications 出版年: 2022 卷: 13 期: 1 **DOI:**10.1038/s41467-022-33763-2）

Emerging unprecedented lake ice loss in climate change projections

Huang, Lei; Timmermann, Axel; Lee, Sun-Seon;等

Seasonal ice in lakes plays an important role for local communities and lake ecosystems. Here we use Large Ensemble simulations conducted with the Community Earth System Model version 2, which includes a lake simulator, to quantify the response of lake ice to greenhouse warming and to determine emergence patterns of anthropogenic lake ice loss. Our model simulations show that the average duration of ice coverage and maximum ice thickness are projected to decrease over the next 80 years by 38 days and 0.23 m, respectively. In the Canadian Arctic, lake ice loss is accelerated by the cold-season polar amplification. Lake ice on the Tibetan Plateau decreases rapidly due to a combination of strong insolation forcing and ice-albedo feedbacks. Comparing the anthropogenic signal with natural variability represented by the Large Ensemble, we find that lake ecosystems in these regions may be exposed to no-analogue ice coverage within the next 4-5 decades.

（来源：Nature Communications 出版年: 2022 卷: 13 期: 1 **DOI:**10.1038/s41467-022-33495-3）

Early stages of sympatric homoploid hybrid speciation in crater lake cichlid fishes

Olave, Melisa; Nater, Alexander; Kautt, Andreas F.; 等

Homoploid hybrid speciation (i.e., hybrid speciation without a change in ploidy) has traditionally been considered to be rare in animals. Only few accepted empirical examples of homoploid hybrid speciation in nature exist, and in only one previous case (insects) was it convincingly shown that this process occurred in complete sympatry. Here, we report an instance of sympatric homoploid hybrid speciation in Midas cichlid fishes in Crater Lake Xiloa, Nicaragua. The hybrid lineage, albeit at an early stage of speciation, has genomically and phenotypically diverged from both of its two parental species. Together with a distinct stable isotope signature this suggests that this hybrid lineages occupies a different trophic niche compared to the other sympatric Midas cichlid species in Crater Lake Xiloa. Here, the authors present a rare example of sympatric homoploid hybrid speciation, without ploidy changes, in the Midas cichlid fishes from Nicaragua. Midas cichlid hybrids occupy a different ecological niche, likely facilitated by body shape adaptations.

（来源：Nature Communications 出版年: 2022 卷: 13 期: 1 **DOI:**10.1038/s41467-022-33319-4）

Epigenetic divergence during early stages of speciation in an African crater lake cichlid fish

Vernaz, Gregoire; Hudson, Alan G.; Santos, M. Emilia;等

Analysis of the DNA methylomes of two ecomorphs of Astatotilapia calliptera from a single lake, which diverged about 1,000 years ago plus a third riverine ecomorph, from which they likely separated about 10,000 years ago, shows epigenetic differences associated with altered transcriptional activity of

ecologically relevant genes, despite low levels of genetic divergence. Epigenetic variation can alter transcription and promote phenotypic divergence between populations facing different environmental challenges. Here, we assess the epigenetic basis of diversification during the early stages of speciation. Specifically, we focus on the extent and functional relevance of DNA methylome divergence in the very young radiation of Astatotilapia calliptera in crater Lake Masoko, southern Tanzania. Our study focuses on two lake ecomorphs that diverged approximately 1,000 years ago and a population in the nearby river from which they separated approximately 10,000 years ago. The two lake ecomorphs show no fixed genetic differentiation, yet are characterized by different morphologies, depth preferences and diets. We report extensive genome-wide methylome divergence between the two lake ecomorphs, and between the lake and river populations, linked to key biological processes and associated with altered transcriptional activity of ecologically relevant genes. Such genes differing between lake ecomorphs include those involved in steroid metabolism, hemoglobin composition and erythropoiesis, consistent with their divergent habitat occupancy. Using a common-garden experiment, we found that global methylation profiles are often rapidly remodeled across generations but ecomorph-specific differences can be inherited. Collectively, our study suggests an epigenetic contribution to the early stages of vertebrate speciation.

（来源：Nature Ecology & Evolution 出版年: 2022 卷: 6 期:12 **DOI:** 10.1038/s41559-022-01894-w）

摘要精选

Concentrations of dissolved organic matter and methane in lakes in Southwest China: Different roles of external factors and in-lake biota

Zhang, Yun; Wang, Jun; Tao, Juan;等

Many factors have been reported to affect material cycling in lakes, but the combined and cascading impacts of external environmental factors and in-lake biota on lake carbon cycling are poorly understood. We elucidated the influencing pathways of geoclimatic factors, lake morphometry, land-use type, chemical and physical factors, and biological taxa (phytoplankton and macroinvertebrates) on the concentrations of two important components of carbon cycling, i.e., dissolved organic matter (DOM) and methane (CH_4) based on datasets from 64 plateau lakes in Southwest China. Partial least squares path modelling (PLS-PM) indicated that (1) geoclimatic factors influenced DOM and CH_4 by affecting land use and lake physical factors (e.g., water temperature), (2) lake morphometry (water depth and lake area) had a direct and great negative effect on the CH_4 concentration related to the production and oxidation of CH_4 and affected phytoplankton and macroinvertebrates by influencing chemical and physical factors, (3) land-use type affected DOM and CH_4 concentrations in both direct and indirect ways, (4) terrestrial humic-like DOM was mainly discharged from forestland and also affected by macro -invertebrates, while the impacts of agricultural and construction land on autochthonous DOM and CH_4 con-centrations mainly occurred by changing nutrients and then the aquatic biota. Moreover, changes in aquatic biota, primarily affected by water quality, influenced DOM spectral properties, and the two biotas affected DOM and CH_4 concentrations differently. Phytoplankton, especially cyanobacteria contributed to (protein-like and humic-like) DOM in both direct and indirect ways related to eutrophication, whereas macroinvertebrates influenced DOM possibly by utilization, bioturbation, and microbial decomposition of feces according to their different relationships with DOM spectral indices. Additionally, CH_4 production can be enhanced by DOM accumulation, and the significant positive correlations of CH_4 concentrations with protein-like DOM and bio-logical index indicate that autochthonous DOM may play an important role for the CH_4 production. Our findings contribute to the understanding of lake carbon cycling under natural conditions and anthropogenic disturbances.

（来源: Water Research 出版年: 2022,**DOI:** 10.1016/j.watres.2022.119190）

Microplastics distribution characteristics in typical inflow rivers of Taihu lake: Linking to nitrous oxide emission and microbial analysis

Li, Lu; Li, Fangbai; Deng, Min;等

The microplastics in nature water are important for the environmental fate of nitrous oxide (N_2O). This study investigated the influence and microbial mechanism of microplastic abundance to the N_2O flux in typical inflow rivers of Taihu lake. The microplastic abundance were in a range of 160-700 particles/m(3) surface water, and 514-3018 particles/kg dry sediment. The highest percentage of microplastic color was transparent, significantly higher than other color ($p<0.0001$) in both surface water and sediment. The dominant microplastic size was 500-5000 mu m in surface water, while size lower than 1000 mu m was dominant in sediment. The microplastic abundance in sediment was negatively correlated with the concentration of suspended sediments (SPS) ($p<0.05$), Chl-a ($p<0.05$), NH (+)(4)-N ($p<0.05$) and TP ($p<0.01$) in inflow river surface water. The dissolved N_2O concentration were 45.71-132.42 nmol/L, and

the N_2O fluxes were 29.85-276.60 mu mol/m(2)/d. The dissolved N_2O concentration was significantly correlated with the nirK abundance and nirK/nosZI ratio negatively ($p<0.05$), revealed that sediment nirK-type denitrification was the main driver of dissolved N_2O. Meanwhile, the N_2O flux (water-air interface) was significantly correlated with nosZI, napA, narG and nirS negatively, implied that nitrification and denitrification interaction in sediment is the main influence factor. The denitrification process in sediment was the main driven factor of N_2O releasing. Mantel-test shows that microplastic abundance in surface water was significantly correlated with nitrification (p = 0.001 similar to 0.01) and denitrification = 0.01 similar to 0.05) genera in water. The dominant denitrification microorganism was Dechloromonas in sediment and Flavobacterium in surface water. These results provided new insight into the fact that plastisphere which comprises microbial community on microplastic could affect the N_2O emission in aquatic system.

（来源: Water Research 出版年: 2022,**DOI:** 10.1016/j.watres.2022.119117）

Application of agricultural pesticides in a peak period induces an abundance decline of metazoan zooplankton in a lake ecosystem

Kong, Ren; Yang, Chunxiang; Huang, Kai; 等

The contamination of pesticides has been recognized as a major stressor in fresh water ecosystems in terms of the losses of services and population declines and extinctions. However, information on the adverse effects of pesticides on zooplankton communities under natural field conditions are still lacking, although zooplankton is quite sensitive to most of pesticides in laboratory studies. In this study, a natural lake ecosystem (Liangzi Lake) was used to determine the relationship between pesticide contamination and abundance decline of metazoan zooplankton. In August 2020, the comprehensive trophic level indexes and the abundance of phytoplankton in the 14 sampling sites of Liangzi Lake were comparable, but the abundance of metazoan zooplankton showed significant variations across two orders of magnitude. These results suggested that other factors, such as pesticide contamination, might be responsible for the variations of metazoan zooplankton community. Furthermore, the responsible pesticides were screened, and totally 29 pesticides were obtained. Finally, five pesticides were identified to provide more than 99.4% toxic contributions and chlorpyrifos and cypermethrin were two main causal agents. These results were further supported by laboratory exposure experiments using D. magna and field study in November 2020, where the concentrations of the 29 pesticides were strongly decreased and the abundance of metazoan zooplankton was comparable across the 14 sites of Liangzi Lake. Taken together, this work provided an evidence that the contamination of pesticides might be responsible for the abundance decline of metazoan zooplankton in a natural freshwater ecosystem.

（来源: Water Research 出版年: 2022,**DOI:** 10.1016/j.watres.2022.119040）

Determining whether hydrological processes drive carbon source and sink conversion shifts in a large floodplain-lake system in China

Wang, Shuoyue; Gao, Yang; Jia, Junjie;等

Lake carbon (C) cycling is a key component of the global C cycle and associated C source and sink processes. The partial pressure of carbon dioxide (pCO_2) and carbon dioxide (CO_2) exchange flux at the lake-air interface (Fc) are controlled by complex physical, chemical, and biological mechanisms. It would be instructively significant to determine whether hydrological processes drive conversion shifts between C sources and sinks in floodplain-lake systems. Findings from this study show that exogenous input and

in situ metabolism related to photosynthesis, respiration, and organic matter degradation were the main driving mechanisms of CO_2 absorption and release in a large floodplain-lake system (i.e., Lake Poyang). Moreover, the intense and frequent water-level fluctuations inherent to floodplain-lakes may also have a direct or indirect impact on C cycling processes and CO_2 exchange rates in floodplain-lake systems via their effect on physical processes, inorganic C transport, in-situ metabolic processes. We confirmed the potential of C source and sink conversion in floodplain-lakes under hydrological fluctuations, and strengthen the understanding of driving mechanisms of C source and sink conversion in floodplain systems.

（来源: Water Research 出版年: 2022,**DOI:** 10.1016/j.watres.2022.119105）

Integrated evaluation of the reactive oxygen species (ROS) production characteristics in one large lake under alternating flood and drought conditions

Song, Na; Wu, Dinggui; Xu, Huacheng;等

Reactive oxygen species (ROS) are omnipresent in natural aquatic environments, and play an important role in biogeochemical cycles. One of the dominant sources of ROS in surface waters was thought to be from dissolved organic matter (DOM) interacting with photochemical process. The properties of DOM were different between the flood and drought periods in lakes; yet, information on how these variations influence ROS photoproduction is unknown. Through a three-year study, the photochemical properties of DOM and the resultant ROS photo -production between the flood and drought period were determined in the largest freshwater lake in China (Lake Poyang). Results found that quantum yield coefficients of excited triplets (3CDOM*), apparent quantum yields of singlet oxygen (1O2) and hydroxyl radicals (center dot OH) were holistically higher in the flood period than those in the drought period. The optical properties of DOM showed that DOM in the flood period featured an allochthonous input, accompanied by higher molecular size (E2/E3), aromatic content (SUVA254), humification degree (HIX), while DOM in the drought period was mainly internal input. Fourier transform ion cyclotron resonance mass spectrometry (FI-ICR MS) further revealed that some refractory components, such as lignin-like and carboxyl-rich alicyclic molecules (CRAM) presented higher abundance in the flood period, and played the positive impacts on ROS production. Orthogonal partial least squares (OPLS) were used to build novel multivariate predictive models for indicating the spatio-temporal ROS production. Also, the relatively higher steady-state concentrations of 3CDOM* and 1O2 in the flood period could significantly diminish the half-lives of acetochlor. Considering the photochemical activity of DOM varied considerably at different periods, this study provided a new method to predict ROS production and contributed to a new insight into stage-specific emerging contaminants removing in natural aquatic environments.

（来源: Water Research 出版年: 2022,**DOI:** 10.1016/j.watres.2022.119136）

How phytoplankton biomass controls metal(loid) bioaccumulation in size-fractionated plankton in anthropogenic-impacted subtropical lakes: A comprehensive study in the Yangtze River Delta, China

Zheng, Siwen; Wang, Rui; Kainz, Martin J.;等

Phytoplankton biomass can significantly affect metal(loid) bioaccumulation in plankton, but the underlying mechanisms are still controversial. We investigated the bioaccumulation of eight metal(loid)s (As, Co, Cu, Hg, Mn, Pb, Se, and Zn) in three size categories of planktonic organisms - seston (0.7-64

mu m), mesozooplankton (200-500 mu m), and macrozooplankton (> 500 mu m) - sampled from six freshwater lakes in two seasons in the Yangtze River Delta, China. Our results highlight phytoplankton biomass is the major driver on metal(loid) bioaccumulation in the studied anthropogenic-impacted subtropical lakes, mainly via affecting site-specific water physiochemical characteristics and plankton communities. However, such impact is highly dependent on chlorophyll a (Chl-a) concentration. The bioaccumulation of metal(loid)s in size-fractionated plankton declined significantly with increasing phytoplankton biomass when Chl-a was below-50 mu g L-1, mainly owing to the reduced metal(loid) bioavailability and subsequent bioaccumulation at more productive sites (with elevated pH and dissolved organic carbon), rather than algal bloom dilution. To a lesser extent, phytoplankton growth dilution and the smaller body-size of zooplankton at more productive sites also contributed to the lower metal(loid) bioaccumulation. The bioaccumulation of metal(loid)s was enhanced under severe algal bloom conditions (when Chl-a concentration was higher than-50 mu g L-1). Although the underlying mechanisms still require further investigations, the potential risks of metal(loid) bioaccumulation under severe algal bloom conditions deserve special attention.

（来源: Water Research 出版年: 2022,**DOI:** 10.1016/j.watres.2022.119075）

Detritus-hosted methanogenesis sustains the methane paradox in an alpine lake

Bartosiewicz, Maciej; Venetz, Jessica; Laeubli, Saskia; 等

Accumulation of methane in oxic waters of lakes and the ocean has been widely reported. Despite the importance for the greenhouse gas budget, mechanistic controls of such methane paradox remain elusive. Here, we use a combination of CH_4 concentration and isotopic (delta C-13(CH_4), delta D-H2O and delta O-18(H2O)) measurements, plankton incubations and microbial community assessments to demonstrate the existence of the methane paradox in oxygenated waters of a meromictic lake (Lake Cadagno, Switzerland). Following mass dynamics using water isotopes, we exclude the possibility that the accumulation of CH_4 at the thermocline results solely from lateral transport. Interannual variability in the magnitude of the methane paradox (between 0.5 and 5 mu mol L^{-1}) is associated to stratification patterns, changes in zooplankton biomass and planktonic detritus accumulation along density gradients, as well as fluctuating microbial cell numbers. The links between hydrodynamic conditions, aggregation of planktonic detritus and its microbiome, as well as the accumulation of CH_4 in the water column are further supported by high-resolution echosounder revealing backscatter maxima at the top of the thermocline, where detritus is effectively trapped, and by oxic incubations showing that CH_4 is produced in zooplankton detritus (0.046 nmol L^{-1} to 0.095 CH_4 mg dry mass L-1 $d^{(-1)}$). Our results also show that detritus-hosted methanogenesis is stimulated through the addition of methylphosphonate, suggesting that zooplankton-associated microbiomes exploit organic phosphorus compounds to release CH_4. Understanding the variability of the methane paradox in relation to changing hydrodynamics and plankton communities will be crucial to predict the future role of lakes in the global methane budget.

（来源: LIMNOLOGY AND OCEANOGRAPHY 出版年: 2022,**DOI:** 10.1002/lno.12263）

Shallow lakes under alternative states differ in the dominant greenhouse gas emission pathways

Balina, Sofia; Sanchez, Maria Laura; Izaguirre, Irina;等

Over the past decades, shallow lakes of the Pampean Plain, Argentina, have been shifting from clear vegetated to turbid phytoplanktonic states due to anthropic pressures. It is not clear, though, if this change in state also involves a change in the overall CO_2 and CH_4 balance of these lakes. Therefore, the main objective of this work was to assess potential differences in the C gas (CH_4 and CO_2) balance of shallow lakes under contrasting states-clear vegetated and turbid phytoplanktonic. We sampled two clear and two turbid shallow lakes in the Pampean region along an annual cycle and we measured all of the major C gas emission pathways: diffusive and ebullitive fluxes and also emissions from emergent vegetated habitats. CO_2 and CH_4 diffusive, ebullitive and vegetated habitat fluxes were comparable between states, but they differed in their relative contribution to the C gas balance because of differences in the coverage of the habitats associated to these pathways. Mean annual, area-weighted CO_2 and CH_4 fluxes of clear lakes were 41.9 +/- 19.0 and 15.4 +/- 18.5 mmol m(-2) d(-1), respectively, and 7.7 +/- 7.3 and 17.9 +/- 19.8 mmol m(-2) d(-1) for CO_2 and CH_4 fluxes, respectively, for turbid lakes. Despite major differences in the relative contribution of the emission pathways between states, there was a remarkable convergence between states in total greenhouse gas emissions when expressed in terms of mean annual CO_2 equivalent greenhouse gas flux.

（来源: LIMNOLOGY AND OCEANOGRAPHY 出版年: 2022,**DOI:** 10.1002/lno.12243）

Depth and basin shape constrain ecosystem metabolism in lakes dominated by benthic primary producers

Klaus, Marcus; Verheijen, Hendricus A.; Karlsson, Jan; 等

Metabolism is one of the most fundamental ecosystem processes, but the drivers of variation in metabolic rates among lakes dominated by benthic primary producers remain poorly constrained. Here, we report the magnitudes and potential drivers of whole-lake metabolism across 43 Swedish arctic-alpine lakes, based on the free-water diel oxygen technique with sondes deployed during the open-water season near the surface and bottom of the lakes. Gross primary production (GPP) and ecosystem respiration (R) were strongly coupled and ranged from 0.06 to 0.45 mg and 0.05 to 0.43 mg L-1 d(-1) among lakes. On average, GPP and R decreased eightfold from relatively shallow to deep lakes (mean depth 0.5-10.9 m) and twofold from concave to convex lakes (mean depth: maximum depth 0.2-0.5). We attribute this to light limitation and shape-specific sensitivity of benthic GPP to disturbance by lake ice. Net ecosystem production (GPP-R) ranged from -0.09 to 0.14 mg L-1 d(-1) and switched, on average, from positive to negative towards deeper lakes and lakes richer in dissolved organic carbon (DOC; 0.5-7.4 mg DOC L-1). Uncertainties in metabolism estimates were high (around one and three times mean R and GPP), especially in deep lakes with low insulation and diurnally variable wind speed. Our results confirm the role of DOC in stimulating net heterotrophy and highlight novel effects of lake shape on productivity in benthic-dominated lake ecosystems and its response to changes in lake ice cover.

（来源: LIMNOLOGY AND OCEANOGRAPHY 出版年: 2022,**DOI:** 10.1002/lno.12236）

Deterministic processes drive national-scale patterns in lake surface sediment bacteria and eukaryotic assemblage composition

Pearman, John K.; Adamson, Janet; Thomson-Laing, Georgia; 等

Biological communities within lake surface sediments play a vital role in biogeochemical cycling and ecosystem services. Knowledge on abundance-occupancy patterns and assembly processes across large spatial scales and over multiple environmental gradients is limited, yet essential to aid in protection

and restoration. In the present study, surface sediment samples were collected from 296 lakes across a wide spatial scale and covering multiple interacting environmental gradients including size, depth, altitude, and trophic state. A suite of physicochemical parameters were used to characterize the environmental conditions and bacterial and eukaryotic assemblages were determined using 16S and 18S rRNA metabarcoding. The majority (similar to 55%) of amplicon sequence variants were only found in a single lake with eukaryotes having a more restricted distribution than bacteria. Deterministic processes were inferred to be dominant for both bacteria (78%) and eukaryotes (51%), with variable selection being especially important for bacteria (49%). Variation partitioning indicated that land use in the catchment, which is strongly related to trophic state, was the most important environmental factor in explaining the assemblage composition. This nationwide study across broad gradients provides new insights into the ecology of bacteria and eukaryotes in lake surface sediments and a platform to better understand the effects of multiple environmental stressors on lake sediment assemblages.

（来源: LIMNOLOGY AND OCEANOGRAPHY 出版年: 2022,**DOI:** 10.1002/lno.12247）

Nutrient function over form: Organic and inorganic nitrogen additions have similar effects on lake phytoplankton nutrient limitation

Volponi, Sabrina N.; Wander, Heather L.; Richardson, David C.; 等

The concentration of dissolved organic nitrogen (DON) is increasing in many northern hemisphere lakes, yet its use by phytoplankton and fate in the environment seldom have been quantified. We conducted 1 week, in situ, microcosm incubations across 25 lakes in northeastern North America to understand how DON, dissolved inorganic nitrogen (DIN), and dissolved inorganic phosphorus (P) affected phytoplankton biomass. In addition, we tested whether lakes were limited by single macronutrients (N or P) or colimited by both. Phytoplankton biomass in 80% of lakes responded similarly to DON and DIN additions. Of the lakes where N form produced differential responses, the majority of phytoplankton communities exhibited greater biomass accumulation with DON than DIN. Colimitation was the most common type of nutrient limitation among the study lakes, followed by P limitation. Limitation type shifted with N form in 40% of the study lakes, but without consistent patterns explaining how shifts occurred. Regardless of N form, lakes with watersheds more dominated by agriculture and higher total dissolved nitrogen (TDN) tended to show P-limited phytoplankton responses, while lakes with less agricultural watersheds and lower TDN tended to show colimited phytoplankton responses. Finally, ambient TDN and total phosphorus (TP) nutrient concentrations were stronger predictors of limitation type than ambient TDN : TP ratios. The different contributions of DON and DIN to phytoplankton biomass in some of our study lakes suggest that DON loading from surrounding watersheds may be an overlooked component in predicting phytoplankton productivity and nutrient limitation dynamics in freshwater ecosystems.

（来源: LIMNOLOGY AND OCEANOGRAPHY 出版年: 2022,**DOI:** 10.1002/lno.12270）

Deep photoautotrophic prokaryotes contribute substantially to carbon dynamics in oxygen-deficient waters in a permanently redox-stratified freshwater lake

Cohen, Ashley B. B.; Klepac-Ceraj, Vanja; Bidas, Kristen; 等

In lakes, seasonal phytoplankton blooms and allochthonous plant debris intensify particulate organic carbon fluxes to the lakebed. Microbes associated with these particles likely vary with organic substrate

lability and redox conditions. To explore microbial compositional responses to these variables, we analyzed particle-associated and free-living assemblages in the permanently redox-stratified Fayetteville Green Lake using 16 S rRNA amplicon sequencing during the peak and end of cyanobacterial and photoautotrophic sulfur bacterial blooms. Assemblage compositions were strongly influenced by redox conditions and particle association. Assemblage compositions varied seasonally above the lower oxycline boundary (summer-generalist heterotrophs; autumn-iron reducers and specialist heterotrophs), but not in the anoxic region below. Particle-associated assemblages were less diverse than free-living assemblages and were dominated by heterotrophs that putatively metabolize complex organic substrates, purple sulfur bacteria, sulfur-cycling Desulfocapsa, and eukaryotic algae. The least diverse particle-associated assemblages occurred near the lower oxycline boundary, where microbial activities and abundances were highest, and anoxygenic photoautotrophs were enriched. The low-diversity particle-associated heterotrophs likely remineralize complex organic substrates, releasing simpler organic substrates to free-living assemblages during transit, thereby influencing surrounding microbial diversity and function. Our results challenge the paradigm that phytoplankton from the shallow photic zone are the primary contributor to the vertical flux. We suggest that photoautotrophic prokaryotes from the deep photic zone contribute significantly to deep-water carbon in this environment, and possibly in other oxygen-deficient waters with sulfidic photic zones. Furthermore, results suggest that seasonally variable terrestrial carbon and metal inputs also influence microbial diversity and function in similar systems.

（来源: LIMNOLOGY AND OCEANOGRAPHY 出版年: 2022,**DOI:** 10.1002/lno.12262）

Carp stocking and climate change are potentially more important factors than nutrient enrichment driving water quality deterioration in subtropical freshwater lakes in China

Su, Haojie; Chen, Jianfeng; Li, Yun; 等

Freshwater lakes across the world have undergone dramatic changes in biological components and water quality over the past several decades. Previous studies focused on potential drivers mainly on nutrient enrichment in the catchment. However, the relative importance of climate change and the top-down cascade effects of fish stocking on water quality is not fully understood. Here, by compiling 155 lakes data with four periods of field investigation in subtropical lakes in China, we found no significant changes in water total nitrogen and total phosphorus in the past two decades. However, the phytoplankton abundance increased significantly, and the water clarity declined by 44.1%. We further found that carp stocking and climate change are potentially more important than nutrients driving water quality change, which is also evidenced in two lakes (Lake Donghu and Qiandao) with long-term monitoring histories. Specifically, carp stocking can decrease the water clarity directly by stirring up sediment and indirectly by trophic cascade along the food web. For climatic factors, mean annual temperature (MAT) has a positive effect on phytoplankton abundance, while mean annual precipitation has a negative one, with climates overall having little effect on water clarity. In addition, nutrient enrichment and climate change also have strong interactions with carp stocking, which may enhance the top-down effects on water quality. Our findings highlight that either MAT or carp stocking may become an overwhelming driver of water clarity decline, which provides new insights into the conservation strategy for water quality management in the subtropical lakes in China.

（来源: LIMNOLOGY AND OCEANOGRAPHY 出版年: 2022,**DOI:** 10.1002/lno.12280）

Homogenisation of water and sediment bacterial communities in a shallow lake (lake Balihe, China)

Zhong, Meifang; Capo, Eric; Zhang, Huayong; 等

Planktonic and benthic bacterial communities hold central roles in the functioning of freshwater ecosystems and mediate key ecosystem services such as primary production and nutrient remineralisation. Although it is clear that such communities vary in composition both within and between lakes, the environmental factors and processes shaping the diversity and composition of freshwater bacteria are still not fully understood. In order to assess seasonal and spatial variability in lake bacterial communities and identify environmental factors underpinning biogeographical patterns, we performed a large-scale sampling campaign with paired water and sediment sample collection at 18 locations during four seasons in Lake Balihe, a subtropical shallow fish-farming lake in mid-eastern China. Pelagic and benthic bacterial communities were distinctly different in terms of diversity, taxonomic composition and community structure, with Actinobacteria, Bacteroidetes, Cyanobacteria and Alphaproteobacteria dominating lake water, and Acidobacteria, Bacteroidetes, Chloroflexi, Gammaproteobacteria and Deltaproteobacteria dominating sediment. Nevertheless, these two communities had stronger spatial concordance and overlap in taxa during spring and autumn seasons. Together, the main drivers of both the spatial and temporal variations in Lake Balihe bacterial communities were identified as water temperature, turbidity, nitrogen and phosphorus availability, and thermal stratification controlled by wind-mixing and activity of the dense farmed fish populations. Notably, populations affiliated with Firmicutes, known to be abundant in fish gut microbiome, were especially abundant in the summer season and locations where high fish biomass was found, suggesting a potential link between fish gut microbiome and the pelagic bacterial communities. Our findings demonstrated seasonal homogenisation of pelagic and benthic bacterial communities linked to marked shifts in a set of seasonally-driven environmental variables including water temperature and nutrient availability.

（来源: FRESHWATER BIOLOGY 出版年: 2022,**DOI:** 10.1111/fwb.14016）

Fish community composition in small lakes: The impact of lake genesis and fisheries management

Matern, Sven; Klefoth, Thomas; Wolter, Christian; 等

1. Gravel pit lakes are common across Europe. These novel ecosystems serve as model systems to study human-induced and natural colonisation of isolated lakes by fish. Fisheries-management activities can quickly spread species over large distances, possibly homogenising fish communities across ecosystems, while fostering local fish diversity. 2. Our objective was to evaluate the effects of lake genesis (gravel pit lakes < 100 years old vs. natural lakes of glacial genesis similar to 10,000 years old) and fisheries management (fish stocking activities present vs. absent) on the fish community in small lakes, while controlling for key environmental variables known to affect lake fish communities. 3. We sampled fish communities by electrofishing and multimesh gillnetting in 47 isolated lakes managed for fisheries, and 19 unmanaged and isolated lakes of both natural and artificial origin in northern Germany. Unmanaged lakes were used as reference to assess fisheries-management impacts in small natural and artificial lakes. 4. We caught 178,506 fish from 30 species and found that the accumulation of native lake fish species in lakes was associated with fisheries management, which increased local species richness (alpha-diversity) and number of predatory species, and reduced among-lake variation in fish community composition (beta-diversity; i.e., homogenisation). The homogenisation-effect associated with fisheries

happened with introduced native fish species, whereas non-native species were rarely detected. 5. In unmanaged gravel pit lakes, the littoral fish community composition was substantially different to the communities present in both types of managed lakes and unmanaged natural lakes. Therefore, the relatively young unmanaged gravel pit lakes revealed evidence of ongoing, stochastic colonisation processes that resulted in comparatively species-poor fish communities. 6. We concluded that fisheries management by anglers speeds up the colonisation of gravel pit lakes with native fish species in the study area. For planning initial fish introductions in newly created gravel pit lakes, it is recommended that fish communities from ecologically similar natural lakes within the same geographical region are used as references to maintain the biotic integrity of newly created fish communities.

（来源: FRESHWATER BIOLOGY 出版年: 2022,**DOI:** 10.1111/fwb.14001）

Investigating the effects of anthropogenic stressors on lake biota using sedimentary DNA

Barouillet, Cecilia; Monchamp, Marie-Eve; Bertilsson, Stefan; 等

Analyses of sedimentary DNA (sedDNA) have increased exponentially over the last decade and hold great potential to study the effects of anthropogenic stressors on lake biota over time. Herein, we synthesise the literature that has applied a sedDNA approach to track historical changes in lake biodiversity in response to anthropogenic impacts, with an emphasis on the past c. 200 years. We identified the following research themes that are of particular relevance: (1) eutrophication and climate change as key drivers of limnetic communities; (2) increasing homogenisation of limnetic communities across large spatial scales; and (3) the dynamics and effects of invasive species as traced in lake sediment archives. Altogether, this review highlights the potential of sedDNA to draw a more comprehensive picture of the response of lake biota to anthropogenic stressors, opening up new avenues in the field of paleoecology by unrevealing a hidden historical biodiversity, building new paleo-indicators, and reflecting either taxonomic or functional attributes. Broadly, sedDNA analyses provide new perspectives that can inform ecosystem management, conservation, and restoration by offering an approach to measure ecological integrity and vulnerability, as well as ecosystem functioning.

（来源: FRESHWATER BIOLOGY 出版年: 2022,**DOI:** 10.1111/fwb.14027）

Local environmental conditions influence species replacement in Great Lakes interdunal wetland macroinvertebrate communities

Stewart, Nicole A.; Schriever, Tiffany A.

Understanding the role of environmental filtering and spatial processes along environmental gradients in assembling and maintaining aquatic communities in rare habitats is crucial for land management and biological conservation. We investigated the relative roles of environmental and spatial factors influencing beta (beta) diversity of aquatic macroinvertebrate assemblages in 36 interdunal wetlands from five freshwater sand dune areas across two ecoregions spanning the latitudinal gradient of Lake Michigan. We hypothesised that aquatic macroinvertebrate diversity and composition would vary along the coastline because of an underlying environmental gradient. We predicted high species replacement correlated with environmental (local and regional) conditions and increasing species diversity with decreasing latitude. We calculated sample completeness, obtained diversity estimates based on Hill numbers and used abundance-based beta partitioning and multivariate analysis to examine beta diversity, and its replacement and nestedness components in relation to local and regional predictors. Despite a

short latitudinal gradient, we detected a significant increase in species richness with decreasing latitude, underpinned by a strong temperature and precipitation gradient. Species replacement (balanced variation in abundance) was high at all spatial scales (wetland, dune area, ecoregion and coastline), and correlated with local and regional environmental variables. Community dissimilarity showed no marked increase with spatial extent, which suggests a system where local-scale environmental filtering prevents dispersal driven homogenisation. Both local and bioclimatic factors were correlated with aquatic macroinvertebrate dissimilarity, but local factors played a larger role. This study simultaneously examined the response of alpha and beta diversity to geographical and environmental variables. Our results indicate that macroinvertebrates respond to abiotic factors by tracking suitable environmental conditions among locally variable interdunal wetlands. Thus, high dispersal along the coastline conveys resiliency to a hydrologically dynamic wetland system, which allows aquatic macroinvertebrates to contribute an integral portion of sand dune biodiversity within the Laurentian Great Lakes region. The high species turnover found suggests that conservation strategies should consider coastline connectivity among dune areas to maintain freshwater biodiversity.

（来源: FRESHWATER BIOLOGY 出版年: 2022,**DOI:** 10.1111/fwb.14008）

A Bayesian approach for remote sensing of chlorophyll-a and associated retrieval uncertainty in oligotrophic and mesotrophic lakes

Werther, Mortimer; Odermatt, Daniel; Simis, Stefan G. H.;等

Satellite remote sensing of chlorophyll-a concentration (chla) in oligotrophic and mesotrophic lakes faces un-certainties from sources such as atmospheric correction, complex inherent optical property compositions, and imperfect algorithmic retrieval. To improve chla estimation in oligo-and mesotrophic lakes, we developed Bayesian probabilistic neural networks (BNNs) for the Sentinel-3 Ocean and Land Cover Instrument (OLCI) and Sentinel-2 MultiSpectral Imager (MSI). The BNNs were built using an in situ dataset of oligo-and mesotrophic water bodies (1755 observations from 178 systems; median chla: 5.11 mg m- 3, standard deviation: 10.76 mg m-3) and provide a per-pixel uncertainty percentage associated with retrieved chla. Shifts of oligo-and meso-trophic systems into the eutrophic regime, characterised by higher biomass levels, are widespread. To account for phytoplankton biomass fluctuation, a set of eutrophic lakes (167 observations from 31 systems) were included in this study (maximum chla 68 mg m-3). The BNNs were evaluated through five assessments including single day and time series match-ups with OLCI and MSI. OLCI BNN accuracy gains of >25% and MSI BNN accuracy gains of >15% were achieved in the assessments when compared to chla reference algorithms for oligotrophic waters (chla <= 8 mg m-3). In comparison to the reference algorithms, the accuracy gains of the BNNs decreased as chla and trophic levels increased. To measure the quality of the provided BNN uncertainty estimate, we calculated the prediction interval coverage probability (PICP), Sharpness and mean absolute calibration difference (MACD) metrics. The associated BNN chla uncertainty estimate included the reference in situ chla values for most ob-servations (PICP >= 75%) across the different performance assessments. Further analysis showed that the BNN chla uncertainty estimate was not constantly well-calibrated across different evaluation strategies (Sharpness 1.7-6, MACD 0.04-0.25). BNN uncertainties were used to test two chla improvement strategies: 1) identifying and filtering uncertain chla estimates using scene-specific thresholds, and 2) selecting the most accurate prior atmospheric correction algorithm per individual satellite observation to retain chla with the lowest BNN un-certainty. Both strategies increased the quality of the chla result and demonstrated the significance of uncertainty estimation. This study serves as research on Bayesian machine learning for the estimation and

visualisation of chla and associated retrieval uncertainty to develop harmonised products across OLCI and MSI for small and large oligo-and mesotrophic lakes.

（来源: REMOTE SENSING OF ENVIRONMENT 出版年: 2022,**DOI:**10.1016/j.rse.2022.113295）

Nitrification Regulates the Spatiotemporal Variability of N_2O Emissions in a Eutrophic Lake

Liang, Xia; Wang, Baoli; Gao, Dengzhou;等

Nitrous oxide (N_2O) emissions from lakes exhibit significant spatiotemporal heterogeneity, and quantitative identification of the different N_2O production processes is greatly limited, causing the role of nitrification to be undervalued or ignored in models of a lake's N_2O emissions. Here, the contributions of nitrification and denitrification to N_2O production were quantitatively assessed in the eutrophic Lake Taihu using molecular biology and isotope mapping techniques. The N_2O fluxes ranged from -41.48 to 28.84 mu mol $m^{(-2)}$ $d^{(-1)}$ in the lake, with lower N_2O concentrations being observed in spring and summer and significantly higher N_2O emissions being observed in autumn and winter. The 15N site preference and relevant isotopic evidence demonstrated that denitrification contributed approximately 90% of the lake's gross N_2O production during summer and autumn, 27-83% of which was simultaneously eliminated via N_2O reduction. Surprisingly, nitrification seemed to act as a key process promoting N_2O production and contributing to the lake as a source of N_2O emissions. A combination of N_2O isotopocule-based approaches and molecular techniques can be used to determine the precise characteristics of microbial N_2O production and consumption in eutrophic lakes. The results of this study provide a basis for accurately assessing N_2O emissions from lakes at the regional and global scales.

（来源: ENVIRONMENTAL SCIENCE & TECHNOLOGY 出版年: 2022,**DOI:**10.1021/acs.est.2c03992）

Suspect Screening and Nontargeted Analysis of Per- and Polyfluoroalkyl Substances in a Lake Ontario Food Web

Ren, Junda; Fernando, Sujan; Hopke, Philip K.;等

Per-and polyfluoroalkyl substances (PFAS) are globally distributed in the natural environment, and their persistent and bioaccumulative potential illicit public concern. The production of certain PFAS has been halted or controlled by regulation due to their adverse effect on the health of humans and wildlife. However, new PFAS are continuously developed as alternatives to legacy PFAS. Additionally, many precursors are unknown, and their metabolites have not been assessed. To better understand the PFAS profiles in the Lake Ontario (LO) aquatic food web, a quadrupole time-of-flight mass spectrometer (QToF) coupled to ultrahigh-performance liquid chromatography (UPLC) was used to generate high-resolution mass spectra (HRMS) from sample extracts. The HRMS data files were analyzed using an isotopic profile deconvoluted chromatogram (IPDC) algorithm to isolate PFAS profiles in aquatic organisms. Fourteen legacy PFAAs (C5-C14) and 15 known precursors were detected in the LO food web. In addition, over 400 unknown PFAS features that appear to biomagnify in the LO food web were found. Profundal benthic organisms, deepwater sculpin(Myoxocephalus thompsonii), and Mysis were found to have more known precursors than other species in the food web, suggesting that there is a large reservoir of fluorinated substances in the benthic zone.

（来源: ENVIRONMENTAL SCIENCE & TECHNOLOGY 出版年: 2022,**DOI:**10.1021/acs.est.2c04321）

Legacy of Coal Combustion: Widespread Contamination of Lake Sediments and Implications for Chronic Risks to Aquatic Ecosystems

Wang, Zhen; Cowan, Ellen A.; Seramur, Keith C.;等

Elevated concentrations of toxic elements in coal ash pose human and ecological health risks upon release to the environment. Despite wide public concerns about water quality and human health risks from catastrophic coal ash spills and chronic leaking of coal ash ponds, coal ash disposal has only been partially regulated, and its impacts on aquatic sediment quality and ecological health have been overlooked. Here, we present a multiproxy approach of morphologic, magnetic, geochemical, and Sr isotopic analyses, revealing unmonitored coal ash releases over the past 40 to 70 years preserved in the sediment records of five freshwater lakes adjacent to coal-fired power plants across North Carolina. We detected significant sediment contamination and potential chronic ecological risks posed by the occurrence of hundreds of thousands of tons of coal ash solids mainly resulting from high-magnitude stormwater runoff/flooding and direct effluent discharge from coal ash disposal sites. The proximity of hundreds of disposal sites to natural waterways across the U.S. implies that such contamination is likely prevalent nationwide and expected to worsen with climate change.

（来源: ENVIRONMENTAL SCIENCE & TECHNOLOGY 出版年: 2022,**DOI:**10.1021/acs.est.2c04717）

Nonhomologous Black Carbon Decoupled Char and Soot Sequestration Based on Stable Carbon Isotopes in Tibetan Plateau Lake Sediment

Meng, Lize; Yu, Heyu; Bai, Yixin; 等

Combustion-derived black carbon (BC) is an important component of sedimentary carbon pool. Due to different physicochemical properties, determining the source of char and soot is crucial for BC cycling, especially for nonhomologous char and soot in the Tibetan Plateau (TP). This study analyzed the sequestration and source of BC, char, and soot in the Dagze Co (inner TP) sediment core via the content and delta 13C, revealing the biomass and fossil fuel driving on nonsynchronous char and soot and their response to local anthropogenic activities and atmospheric transmission. The results showed that BC concentration increased from 1.19 +/- 0.35 mg g-1 (pre-1956) to 2.03 +/- 1.05 mg g-1 (after 1956). The variation of char was similar to BC, while nonhomologous growth was detected in char and soot ($r = 0.29$ and $p > 0.05$). The source apportionment showed that biomass burning for 71.52 +/- 10.23% of char and promoted char sequestration. The contribution of fossil fuel combustion to soot (46.67 +/- 14.07%) is much higher than char (28.48 +/- 10.23%). Redundancy analysis confirmed that local anthropogenic activities significantly influenced BC burial and atmospheric transport from outside TP-regulated BC burial. The contribution of biomass and fossil fuels to nonsynchronous char and soot is conducive to understanding the anthropogenic effect on BC burial in the TP.

（来源: ENVIRONMENTAL SCIENCE & TECHNOLOGY 出版年: 2022,**DOI:**10.1021/acs.est.2c07916）

Algal Density Controls the Spatial Variations in Hg Bioconcentration and Bioaccumulation at the Base of the Pelagic Food Web of Lake Taihu, China

Li, Pengwei; Wang, Rui; Kainz, Martin J.;等

Algal density can significantly impact mercury (Hg) bioaccumulation and biomagnification in aquatic food webs, but the underlying mechanisms remain controversial especially in subtropical and tropical regions.

We conducted a comprehensive field study on Hg bioconcentration in phytoplankton and bioaccumulation in size-fractionated zooplankton across 17 sampling sites in Lake Taihu, a large shallow lake in eastern China with large spatial differences in algal density. The higher algal density in the northern sites is highly associated with the lower THg bioconcentration factor (BCF) in phytoplankton and lower THg bioaccumulation factor (BAF) in zooplankton. The low Hg BCFs or BAFs at productive sites could not be explained by algal bloom dilution but attributed to the low Hg bioavailability, which is highly associated with the elevated pH levels at productive sites. The smaller body size of the dominant zooplankton species at higher algal density sites also contributed to their lower Hg bioaccumulation. Importantly, we provide evidence that high algal density is associated with a low proportion of methylmercury (MeHg) in total Hg (% MeHg) in phytoplankton, which is further transferred to zooplankton. Such a low THg BCF or BAF and low % MeHg in plankton at high algal density sites hamper the entry of Hg into the pelagic food webs, which are important but yet underestimated driving forces for the low Hg contents in pelagic fish that are commonly observed in anthropogenic-impacted eutrophic lakes in subtropical regions.

（来源: ENVIRONMENTAL SCIENCE & TECHNOLOGY 出版年: 2022,**DOI:**10.1021/acs.est.2c05625）

Spatial distribution of nutrient loads and thresholds in large shallow lakes: The case of Chaohu Lake, China

Wei, Zhen; Yu, Yanxin; Yi, Yujun

Persistent eutrophication frequently causes toxic algal blooms, which is a serious threat to drinking water safety, food security, and public health. Nutrient thresholds, the maximum nutrient load that an aquatic ecosystem can absorb while meeting management objective, are key to avoiding and reducing blooms. The determination of thresholds relies on nutrient load-response curves. The spatial heterogeneity of large shallow lakes in terms of lake characteristics results in different curves shape among areas of the lake, which leads to spatial differences in thresholds. However, the spatial heterogeneity of thresholds is typically neglected; there are few methods to analyse the relationship between river loads and lake-specific area thresholds. Here, we proposed the Area Threshold Analysis Framework to analyse the spatial patterns of nutrient loads and thresholds in lakes. We first quantified the flow and load of the rivers entering the lake. The lake was then zoned and modelled to analyse area thresholds. Finally, an intuitive link between the nutrient loads of specific rivers and the thresholds of specific areas of the lake was established. The results showed a nonlinear without hysteresis response in all areas of Chaohu Lake; the nutrient loads and thresholds were highly variable in space, showing a trend of increasing and then decreasing from west to east. Flow density and wind might be important in influencing the spatial distribution of thresholds. The different effects of the wind and flow density on total phosphorus (TP) and chlorophyll a (Chl-a) lead to large differences in the thresholds with TP and Chl-a as management objectives, respectively. The large gap between nutrient loads and thresholds made it important for management to consider appropriate management goals to deal with unrealistic nutrient reductions. Achieving year-round Chl-a <= 30 mu g/ l in Chaohu Lake was easier than TP <= 0.05 mg/l, since for the latter, the Shiwuli, Paihe, and Nanfei river loads needed reductions of >80 %. In addition, for Area 1 and 2, it was more practical to first start meeting TP <= 0.05 mg/l for 2 or 3 seasons of the year than for 4 seasons. Overall, we developed a new framework for spatial threshold analysis and established an intuitive link between nutrient loads and thresholds in large shallow lakes. These results are valuable for understanding the threshold properties of spatially heterogeneous ecosystems in general and provide a reference for watershed nutrient management and ecological restoration of lakes.

（来源: JOURNAL OF HYDROLOGY 出版年: 2022,**DOI:**10.1016/j.jhydrol.2022.128466）

Geomorphic control on stage-area hysteresis in three of the largest floodplain lakes

Ang, Wei Jing; Park, Edward; Yang, Xiankun

Hysteresis in floodplain lakes occurs between stage and lake area. Stage-area hysteresis controls the storage and exchange of water and sediments, and is a critical hydrological behavior for lake management. While hysteresis has been repeatedly observed in the floodplain lakes of large rivers, the hydrological mechanism and factors in control have been poorly understood thus far. In this paper, we investigate the role of geomorphology in controlling lake hysteresis, specifically the geologic setting and the lake basin, the lake position relative to the main stem of the river, as well as the influence of lake shape and its internal depositional landforms on inundation dynamics. We study the floodplain lakes along three of the largest rivers around the world: the Curuai Lake of the Amazon River, the Tonle Sap Lake of the Mekong River, and the Poyang Lake of the Yangtze River. The three lakes exhibit a similar counter-clockwise stage-area hysteresis: for a given stage, the lake area is larger in the falling season than in the rising season. Our results indicate that hysteresis is mainly controlled by geomorphology, where the lake shape and basin size lead to delays in the drainage and drop in lake area during the falling season, resulting in counter-clockwise hysteresis. Nevertheless, the lakes are of distinct climatic and geologic-geomorphic settings, representing the variety in the lake types of large rivers. Hence, while geomorphology is the overall driver, unique lake characteristics delay the fall in water extent and shape hysteresis on a case-by-case nature. At Curuai, the complex floodplain morphology (impeded floodplain) complicates and slows the routing of outflow. At Tonle Sap, the lake flows into the river solely through a narrow channel, where a backwater effect restricts drainage. At Poyang, the wide lake shape upstream leads to counter-clockwise hysteresis, while the narrow channel downstream exhibits clockwise hysteresis. Out of the three investigated floodplains, Tonle Sap has the largest degree of hysteresis (0.41), followed by Poyang (0.17) and Curuai (0.13). This trend in hysteresis extent is a result of the different composition of inflow and the lake-river hydrological connectivity, attributed to lake geomorphology. This study is the first to address geomorphology as the primary control over lake hysteresis, which improves understanding of the stage-area curve in empirical and numerical hydrological models, and potentially floodplain management.

（来源: JOURNAL OF HYDROLOGY 出版年: 2022,**DOI:** 10.1016/j.jhydrol.2022.128574）

Fully-covered bathymetry of clear tufa lakes using UAV-acquired overlapping images and neural networks

He, Jinchen; Lin, Jiayuan; Liao, Xiaohan

Accurate and updated bathymetric data is of great significance for the management and protection of alpine tufa lakes. In recent years, unmanned aerial vehicle (UAV)-borne optical remote sensing has become a cost-effective technique for obtaining water depth of small and clear waters like tufa lakes. UAV-based bathymetry can be categorized into photogrammetric approach and spectrally derived approach. Photogrammetric bathymetry is contactless but invalid in water areas with uniform texture, while spectral-based bathymetry requires a large amount of in-situ depth measurements. In this paper, we combined the strengths of the two bathymetric methods to retrieve the depth of clear tufa lakes using neural networks. The surface elevation and orthoimage were first produced from UAV-acquired overlapping images, and then water color-depth tie points were sampled in the orthoimage and

refraction-corrected bathymetric map. Next, the shallow and deep neural networks were separately used to train the regression models for predicting water depth. Lastly, the combined bathymetric methods were compared with the single ones in terms of effective spatial coverage and bathymetry accuracy. The results indicated that the combined methods were superior to single bathymetric methods in fully-covered bathymetry of clear tufa lakes. The shallow neural network-based model achieved the highest accuracy, with the coefficient of determination (R2) of 0.91 and the Root Mean Square Error (RMSE) of 1.12 m, whereas the deep neural network-based model increased the details of water depth distribution.

（来源: JOURNAL OF HYDROLOGY 出版年: 2022,**DOI:** 10.1016/j.jhydrol.2022.128666）

Salinization process in a topographically closed saline lake estimated by radium, barium, and chloride mass balances

Zhang, Xiaolang; Jiao, Jiu Jimmy; Li, Hailong; 等

Under a warming climate, many areas of the world are experiencing drier conditions, leading to the rising lake evaporation rate and salinity. The salinization of a lake, or timescale needed to evolve from historically fresh to presently saline state, is important for understanding the paleo-hydrology and lacustrine geochemical cycling. Solute loss from transport (diffusion, advection, or density flow) and mineral precipitation in lake water are usually neglected in previous studies. Here, the salinization time of a saline lake in the Badain Jaran Desert, China is estimated based on the modified mass balance models of radium, barium, and chloride of lake water by considering the transport and precipitation loss of saline lake solutes. The calculated salinization time is 8,493.7 +/- 1,559 years. The imbalance between imported solutes via groundwater discharge over the salinization time and their inventories in the present lake water suggests significant solute sinks through transport and precipitation. Specifically, sinks of barium, lithium, and strontium, have removed similar to 10-100 times of the present-day inventories dissolved in lake water. These findings can guide the investigation of salinization processes in other saline lakes of similar hydrological and hydrogeological settings.

（来源: JOURNAL OF HYDROLOGY 出版年: 2022,**DOI:** 10.1016/j.jhydrol.2022.128722）

Sediment organic matter properties facilitate understanding nitrogen transformation potentials in East African lakes

Yao, Xiaolong; Zhao, Zhonghua; Wang, Jianjun; 等

East African lakes include the most productive and alkaline lake group in the world. Yet, they generally receive fewer nutrient inputs than the densely populated subtropical and temperate lakes in the northern hemisphere. In these lakes with insufficient supplies of inorganic nitrogen, the mineralization of benthic organic matter can play an important role in driving the nutrient cycle and nitrogen loss. Using a suite of stable 15N isotope dilution and tracer techniques, we examined five main processes of the sediment nitrogen cycle in 16 lakes and reservoirs of Tanzania and Kenya, East Africa: gross nitrogen mineralization, ammonium immobilization, dissimilatory nitrate reduction to ammonium (DNRA), and the dinitrogen (N_2) production via denitrification and anaerobic ammonium oxidation (anammox). Gross nitrogen mineralization and ammonium immobilization showed the maximum values of 9.84 and 12.39 mu mol N kg^{-1} $h(^{-1})$, respectively. Potential DNRA rates ranged from 0.22 to 8.15 mu mol N $kg(^{-1})$ $h(^{-1})$ and accounted for 10 %-74 % (average 25 %) of the total dissimilatory nitrate reduction. Potential nitrate reduction rates in most lakes were dominated by denitrification with a contribution of 26 %-85 % and a mean of 65 %. We further found that the sediment nitrogen transformations were driven mainly by

benthic organic matter properties and water column phosphate concentrations, reflecting microbial metabolic responses to the changing carbon and nutrients availability. For instance, autochthonous production of protein-like organic matter attributed to active sediment nitrogen mineralization, DNRA, and denitrification. In contrast, the high degree of humification caused by the inputs of terrestrial humic-like substances slowed down the sediment nitrogen transformations. The contribution of DNRA to total dissimilatory nitrate reduction was significantly positively correlated to sediment C: N ratios. These results indicate that predictions of sediment N supply and loss in East African lakes can be improved by incorporating sediment organic matter properties.

（来源: SCIENCE OF THE TOTAL ENVIRONMENT 出版年: 2022,**DOI:** 10.1016/j.scitotenv.2022.156607）

The variations of labile arsenic diffusion driven by algal bloom decomposition in eutrophic lake ecosystems

Yao, Yu; Han, Xiaoxiang; Chen, Ying; 等

The vertical labile arsenic (As) concentration and diffusion pattern variations in eutrophic lakes were investigated using in situ techniques of diffusive gradients in thin films (DGT) and high-resolution dialysis (HR-Peeper) in the typ-ical eutrophic system of Lake Taihu in China. In addition, simulation experiments were used to reveal labile As distri-butions in sediment profiles under the influence of algae blooms and wind fluctuations. Our results indicated that eutrophication could lead to the migration and transformation of As fractions, including increased As bioavailability, as well as varied diffusion patterns. The sulfate released from algae decomposition reduced to H_2S and formed FeS, which weak adsorbability contributed to the increased mobility of the As fractions. Meanwhile, further decomposition released a large quantity of algae-derived organic matter which competed with the adsorbed As, leading to more endogenous As migrating to the overlying water. Accordingly, the H_2S production presented a likely explanation for the changed distribution of labile As and contributed to labile As concentrations in the sediment profiles significantly increasing at depths of -20 mm to -60 mm in the early stages of the simulation experiment. Moreover, the areas of enhanced diffusion patterns with high concentrations of As obviously expanded. However, following the complete decomposition of the algae, the organic matter component significantly changed, suggesting an explanation for the var-iations in distribution of labile As. All the diffusion pattern variations showed similar trends. Consequently, variation of labile As diffusion patterns could indicate the decomposition and eutrophication levels of freshwater ecosystems.

（来源: SCIENCE OF THE TOTAL ENVIRONMENT 出版年: 2022,**DOI:** 10.1016/j.scitotenv.2022.156703）

Effects of hydrological connectivity project on heavy metals in Wuhan urban lakes on the time scale

Dou, Yuhang; Yu, Xunru; Liu, Li;等

Metal pollution in lakes threatens the ecological environment and human health. When environmental conditions change, heavy metals (HMs) in lake sediments can cause secondary pollution. At present, the implementation of the Hydrological Connectivity Project (HCP) is a significant means of lake governance. In this study, the accumulation, po-tential ecological risk, and sources of HMs in Four lakes (Houguan Lake, Tangxun Lake, Moshui Lake, and Chen Lake) in Wuhan city were compared before and after the completion of the HCP. The results indicated that the HCP reduced the enrichment factor of HMs and the potential ecological risk in the heavily polluted Moshui Lake but caused second-ary pollution in the less polluted Houguan Lake. Moreover, the degree of purification of lakes that took a longer time to complete

the HCP (Moshui Lake) was significantly higher than that of lakes with a shorter HCP completion time (Tangxun Lake). Water exchange caused by the HCP leading to exchange of the primary pollution source between Houguan Lake and Moshui Lake to a certain extent. This study provides a reference for evaluating the implementation effect of the HCP on HM pollution in lakes and for future governance planning.

（来源: SCIENCE OF THE TOTAL ENVIRONMENT 出版年: 2022,**DOI:** 10.1016/j.scitotenv.2022.158654）

Antibiotic pollution in lakes in China: Emission estimation and fate modeling using a temperature-dependent multimedia model

Cai, Ya-Ya; Zhang, Qian-Qian; Yan, Xiao-Ting;等

The high use of antibiotics worldwide has poses a serious threat to both human and environmental health. Lakes are served as reservoirs for antibiotics, however, there is a lack of information available on antibiotics emissions and the subsequent pollution. Here, the emission and fate of 34 frequently detected antibiotics were studied in 226 Chinese lakes, via the built emission estimation method and a temperature-dependent multimedia lake model. It has been es-timated that totally 5711 tons antibiotic were discharged into the lakes of China in 2019. Antibiotics emissions are due to human activities, with 3800-fold higher emissions in the Eastern China than that in Western China. The antibiotic fate in lakes has been successfully modelled by simulating the lake stratification, freeze-melt cycles and the stable con-dition throughout the year. Both stratification and freeze-melt cycles can lead to increased antibiotic concentrations in lake water. Deep-water lakes were shown to serve as a highly effective natural storage medium for antibiotics. The re-liability of the model was confirmed by published measured concentrations and Monte Carlo method. This is the first study to comprehensively investigate the antibiotic fate in lakes of China, providing valuable guidance for the remedi-ation of contaminated lakes.

（来源: SCIENCE OF THE TOTAL ENVIRONMENT 出版年: 2022,**DOI:** 10.1016/j.scitotenv.2022.156633）

Linking the formation of varves in a eutrophic temperate lake to meteorological conditions and water column dynamics

Zarczynski, Maurycy; Zander, Paul D.; Grosjean, Martin;等

Despite varved sediments being widely used for paleolimnological studies, little information is available about how climate and meteorological signals are recorded in varves at sub-seasonal to annual scale. We investigate links between meteorological and limnological conditions and their influence on biochemical varve formation and preservation of sub-seasonal climate signals in the sediments. Our study site is postglacial Lake Zabinskie located in NE Poland, in which thick and complex varved sediments have been studied for the last decade. These sediments provide an excellent material for studying the influence of short-term weather conditions on geological records. For this, we use an almost decade-long (2012-2019) series of observational data (meteorological conditions, physicochemical water parameters, and modern sedimentation observations) to understand varve formation processes. Then we compare these results with a high-resolution biogeochemical proxy dataset based on mu XRF and hyperspectral imaging (HSI) measurements of a varved sediment core spanning the same period. Here we show direct links between the meteorological and limnological conditions and varve formation processes. This is particularly the case for air temperature which governs calcite laminae formation and primary production. We further show that calcite grain size is influenced by lake mixing intensity resulting from the wind activity, and that holomixis events lead to the formation of distinct manganese (Mn) peaks

in the typically anoxic sediments. Our findings show that high-resolution non-destructive spectroscopy methods applied to complex biochemical varves, in combination with long observational limnological datasets, provide useful information for tracking meteorological and limnological processes in the past.

（来源: SCIENCE OF THE TOTAL ENVIRONMENT 出版年: 2022,**DOI:** 10.1016/j.scitotenv.2022.156787）

Using hierarchical stable isotope to reveal microbial food web structure and trophic transfer efficiency differences during lake melt season

Dang, Zhengzhu; Luo, Zhongxin; Wang, Shuo;等

The microbial food web (MFW) is a material and energy source in lake water ecosystems. Although it is crucial to determine its structure and function for water ecological health, MFW changes during lake melt period have not been well studied. In this study, the MFW was divided into three categories by analyzing its structure and trophic transfer efficiency using hierarchical C/N stable isotopes and eDNA sequencing techniques, including the detrital food web (DFC, 15 %), classical grazing food web (CFC, 60 %), and mixed trophic food web (MFC, 25 %). The trophic structure and type of MFW in ice-melting lakes are always in the process of succession and adaptation, which is in a relatively low trophic transfer efficiency stage under stable conditions (i.e. CFC), whereas the input of exogenous debris and organic pollutants may lead to an increase in MFW trophic transfer efficiency (i.e. MFC, DFC). The trophic transfer efficiency from the previous trophic level to protozoa and micrometazoa was 16.32 % and 20.77 % in DFC and 10.20 % and 29.43 % in MFC, respectively. Both are obviously higher than those of the CFC (11.69 % and 9.45 %, respectively). In terms of trophic structure, the community interaction and trophic cascade effect of DFC and MFC were enhanced but easily changed with environmental factors. In contrast, the core species and cascading effects of the CFC were clearer, and the MFW structure was relatively stable. Overall, this study reveals that the explosive increase in MFW trophic transfer efficiency induced by exogenous input during the lake melt period may subsequently lead to the destabilization of the microbial community structure and cause potential ecological risks. These are manifested in the absence of ecological trophic processes, the decrease in trophic structure complexity and stability, and the weakening of microecology self-adaptive regulation ability.

（来源: SCIENCE OF THE TOTAL ENVIRONMENT 出版年: 2022,**DOI:** 10.1016/j.scitotenv.2022.156893）

Six decades of field observations reveal how anthropogenic pressure changes the coverage and community of submerged aquatic vegetation in a eutrophic lake

Dong, Baili; Zhou, Yongqiang; Jeppesen, Erik; 等

Six decades field observation data series on submerged aquatic vegetation (SAV), water level and water quality from Lake Taihu were compiled to reveal the dynamics in coverage and species composition of SAV and their anthropogenic drivers. We found that both SAV species composition and coverage area declined significantly in Lake Taihu during the period, and the increasing nutrient levels and water level as well as decreasing water clarity were responsible for these change trends. Specifically, the decrease in species richness could be particularly well predicted by total nitrogen (TN) and the ratio of water clarity (i.e., Secchi disk depth (SDD)) to water level (WL), contributing 47.3 % and 32.3%, respectively, while the coverage of macrophytes was most strongly related to the water level, accounting for 70.1 % of the variation. A classification tree analysis revealed a threshold of TN of 3.2 mg/L and SDD/WL of 0.14 that

caused a shift to a eutrophic low-macrophyte dominated state. Our results highlight that SDD/WL must be improved for SAV recolonization, rather than merely reducing nutrient input and regulating water level. Our findings provide scientific information for lake managers to prevent plant degradation in macrophyte-dominant lakes and facilitate a shift to a macrophyte-dominant state in eutrophic lakes.

（来源: SCIENCE OF THE TOTAL ENVIRONMENT 出版年: 2022,**DOI:** 10.1016/j.scitotenv.2022.156878）

Dreissena in the Great Lakes: what have we learned in 30 years of invasion

Karatayev, Alexander Y.; Burlakova, Lyubov E.

We summarized over 30 years of research on zebra and quagga mussels in the Laurentian Great Lakes and compared with data from European and North American inland lakes. Invasion dynamics, growth, and reproduction of dreissenids in the Great Lakes are governed by lake morphometry. At < 30 m mussels overshot their carrying capacity and declined within 13-15 years after first detection. At 30-90 m their densities increased more slowly and declined to a lesser extent, while at > 90 m populations continue to increase even after 30 years of invasion. After the proliferation of quagga mussels, benthic wet biomass (including molluscs shells) increased about two orders of magnitude and currently exceeds zooplankton biomass > 40-fold. Strong benthic/pelagic coupling redirects food and energy from the water column to the bottom causing an increase in Secchi depth, decline in phosphorus, chlorophyll, phytoplankton and zooplankton biomass. The abundance of commercially important fishes declined as a result of the dramatic decrease in their main food deep water amphipods Diporeia, which has been outcompeted by exotic mussels. However, the introduction of round goby into the Great Lakes in the 1990s provided an important link between dreissenids and commercially and recreationally valuable fish species, increasing their productivity.

（来源: HYDROBIOLOGIA 出版年: 2022,**DOI:** 10.1007/s10750-022-04990-x）

A new trophic index (TIM2S) to evaluate trophic alteration of small shallow lakes: a predictive reference-based approach

Labat, Frederic; Thiebaut, Gabrielle

We Small shallow lakes (SSLs) have great conservation value and support numerous ecosystem services. However, these small ecosystems are faced with many threats, including eutrophication, which tends to shift biodiverse SSLs to a turbid state dominated by phytoplankton. The ecological quality of SSLs still remains poorly evaluated because of the lack of adapted tools. We propose a new trophic index-TIM2S-based on the tolerance range of 245 macrophyte species to total phosphorus. As a single trophic index can favour oligotrophic ecosystems and their associated species to the detriment of more eutrophic but rare species, we converted TIM2S into a predictive reference-based model. Then, we compared TIM2S with five existing trophic indices in their efficiency to discriminate trophic levels and disentangle eight anthropogenic or internal pressures. TIM2S was the only index strongly correlated with total phosphorus and able to discriminate trophic levels. Most existing trophic indices are expert-based, and reflect community alteration rather than eutrophication. These expert-based indices are also dependent on numerous environmental factors, highlighting the need for robust predictive models to evaluate ecological statuses accurately. TIM2S is Water Framework Directive-compatible and can be used widely in Europe to evaluate the trophic status and trophic alterations of SSLs.

（来源: HYDROBIOLOGIA 出版年: 2022,**DOI:** 10.1007/s10750-022-05098-y）

Impact of zooplankton grazing on phytoplankton in north temperate coastal lakes: changes along gradients in salinity and nutrients

Christensen, Inge; Pedersen, Lisbeth Kjaereby; Sondergaard, Martin;等

Zooplankton grazing at similar nutrient levels is generally regarded as lower in brackish than in freshwater lakes, but experimental evidence of this is lacking. Accordingly, we conducted short-term zooplankton grazing experiments in bottles with water from 12 Danish brackish lakes covering a large gradient in salinity (0.3-17.4 parts per thousand) and nutrient concentrations as well as with water from 24 mesocosms established in the same area with various salinities (0.5-12 parts per thousand), two nutrient levels and low fish density. Grazing was low in 11 of the 12 lakes, even when they were dominated by edible phytoplankton and nutrient addition led to a major increase in phytoplankton biomass. By contrast, grazing was significant in most of the mesocosms, particularly at high nutrient levels and salinities of 8 parts per thousand or below where Daphnia dominated. Moreover, grazing decreased the biomass of most phytoplankton taxa, except for a few (e.g. Ankyra at 0.5-2 parts per thousand and Ochromonas and Chaetoceros at 8 parts per thousand). Our results provide experimental support for potentially significant grazing by zooplankton on phytoplankton in brackish lakes up to a salinity of 8 parts per thousand at low fish density; however, grazing in summer was generally low in the majority of the lakes, which we attribute to high predation on zooplankton.

（来源: HYDROBIOLOGIA 出版年: 2022,**DOI:** 10.1007/s10750-022-05017-1）

High temperature, predation, nutrient, and food quality drive dominance of small-sized zooplankton in Neotropical lakes

das Candeias, Donisete Aparecido; Moi, Dieison Andre; Simoes, Nadson Ressye;等

Body size plays a key role in the functioning of communities and ecosystems. However, this ecological trait is commonly under strong selection pressure by environmental drivers, such as temperature, nutrients, predation, and food quality. Understanding how environmental factors interact to shape the body size structure of communities is, therefore, of fundamental and applied interest. Using a unique database from 12 Neotropical lakes, we quantified the community-weighted mean trait (CWM) of zooplankton body size. We investigated how temperature, total phosphorus, abundance of predators (planktivorous fish) and food availability (abundance of edible and inedible algae) affect CWM of zooplankton body size. We also analyzed the interactions among these environmental predictors, and their cascading effects on zooplankton body size. We found that planktivorous fish, inedible algae, and edible algae had strong direct impacts on CWM of zooplankton body size. In particular, planktivorous fish and inedible algae decreased the CWM of body size, whereas edible algae increased it. Temperature and total phosphorus indirectly affected CWM of body size by increasing the abundance of planktivorous fish and inedible algae, and decreasing the abundance of edible algae. Our findings illustrate that environmental factors act in combination and affect zooplankton body size through multiple pathways. Therefore, focusing on the interaction between environmental predictors rather than just their isolated effects may provide a more mechanistic understanding of how environmental changes drive the body size structure of biotic communities.

（来源: AQUATIC SCIENCES 出版年: 2022,**DOI:** 10.1007/s00027-022-00881-4）

Significant diurnal variation of CO_2 flux from a shallow eutrophic lake: effects of submerged aquatic vegetation and algae bloom

Zhang, Zhuangzhuang; Yu, Ruihong; Xia, Xinghui;等

Shallow eutrophic lake with submerged aquatic vegetation (SAV) has high primary productivity, but its diurnal variation of CO_2 flux remains unclear. Moreover, algae bloom has become a serious environmental problem; however, its effects are still unclear. Thus, monthly measurement in Lake Ulansuhai, a shallow eutrophic lake in China, was conducted throughout the ice-free period (April-October, 2019), to study monthly and diurnal variation of CO_2 flux and the effects of algae bloom, SAV, and trophic state. Results show that the area with SAV (Site 1) acts as a CO_2 sink during both daytime and nighttime in most months (spanning 5 months), and CO_2 absorption during nighttime accounts for 25-45% of the total daily absorption. In contrast, the area with both SAV and algae (from May to September; Site 2) during whole ice-free period acts as a CO_2 source during nighttime all the time, accounting for 30-100% (average of 80%) of the total daily emissions. Site 1 (without algae) during whole ice-free period acts as a net CO_2 sink with CO_2 flux of -7.3 +/- 4.73 mmol $m(^{-2})$ $d(^{-1})$, whereas Site 2 (with algae) plays as CO_2 source with CO_2 flux of 5.54 +/- 3.15 mmol $m(^{-2})$ $d(^{-1})$. Furthermore, monthly variation during 7 months suggests that total daily CO_2 emission flux in April (after ice-melt period) at Site 1 (without algae) and Site 2 (with algae) reached 17.78 and 34.75 mmol $m(^{-2})$ $d(^{-1})$, respectively, indicating that the period plays an important role for CO_2 emission budget during the whole ice-free period. Results show that the effects of algae bloom and SAV need to be paid more attention in further works.

（来源: AQUATIC SCIENCES 出版年: 2022,**DOI:** 10.1007/s00027-022-00897-w）

Effects of extreme water levels on nutrient dynamics in a large shallow eutrophic lake (Changhu Lake, China)

Wang, Haiyan; Li, Tao; Zhu, Jianqiang; 等

Changhu Lake, a large, shallow, eutrophic lake in central China, experienced an extremely low water level event from November 2015 to January 2016 followed by an extremely high water level event in July 2016. In this study, we examined the effects of two extreme water levels on the nutrient dynamics of Changhu Lake over five years. The nutrient parameters in Changhu Lake showed significant interannual variations, and the nutrient concentrations at the sites in the western part of Changhu Lake were 2-41% higher than those at the outlet of the lake. In late 2015, the effects of low water levels led to a 17-74% increase in nutrient concentrations. After July 2016, however, a high water level event occurred, leading to a 34-48% decrease in nutrient concentrations. These changes in nutrient parameters were strongly related to water level fluctuations ($p < 0.05$). As extreme water levels are likely to become more frequent during the twenty-first century, this work may provide some insights into the conservation and management of lake ecosystems in the face of climate change and human activity.

（来源: JOURNAL OF FRESHWATER ECOLOGY 出版年: 2022,**DOI:** 10.1080/02705060.2021.2023053）

Zooplankton community and its environmental driving factors in Ulungur Lake, China

Wang, Huibo; Huo, Tangbin; Du, Xue; 等

This study investigated the zooplankton community structure in Ulungur Lake, located in the arid region of Northwest China, which has been slightly polluted by exogeneous sources. A total of 44 zooplankton species were identified in Ulungur Lake, which were sorted into seven functional groups: protozoan filter

feeders (PF), rotifer filter feeders (RF), rotifer carnivores (RC), small copepod and cladoceran filter feeders (SCF), mid-sized copepod and cladoceran filter feeders (MCF), mid-sized copepod and cladoceran carnivores (MCC), and large copepod and cladoceran filter feeders (LCF). The dominant zooplankton functional group varied according to seasonal change. The RF group was dominant in the spring, comprising 87.77% of the total biomass. In the summer, the dominant group was SCF, comprising 90.72% of the total biomass, while the RF group accounted for only 7.24%. In the autumn, the biomass was mainly distributed between the RC (36.38%), SCF (30.62%), and RF (30.06%) groups. This seasonal difference in zooplankton community structure is related to fish production in Ulungur Lake, as well as to the competition and predation relationship among zooplankton species. This study showed a significant positive correlation between the PF and LCF groups, and between the RC, MCC, and MCF groups. This positive correlation was found to be related to the competition and predatory relationships between these functional groups. The predation pressure within the zooplankton functional groups in Ulungur Lake was not as significant as the pressure of food competition. The zooplankton biomass showed no significant difference between spring (0.0615 mg/L) and summer (0.0621 mg/L), but the biomass in autumn (0.3051 mg/L) was significantly increased. Nitrite-nitrogen (NO_2-N) and Secchi Depth (SD) had significant correlations between species and functional groups, and were the major driving factors affecting the community structure of Ulungur Lake. In this study, the seasonal variations in the biomass of zooplankton were strongly influenced by environmental factors, which played an important driving role in structuring the ecological communities of zooplankton.

（来源: JOURNAL OF FRESHWATER ECOLOGY 出版年: 2022,**DOI:** 10.1080/02705060.2022.2093279）

Effects of suspended ecological beds on phytoplankton community structure in Baiyangdian Lake, China

Zhu, Hao; Cao, Kun; Chen, Xiaolong; 等

To address the issues of submerged vegetation restoration in the deep-water area of Baiyangdian Lake, a type of suspended ecological bed was developed, which was constructed with aquatic plants, ropes and supporting poles. The depth of a suspended ecological bed could be adjusted based on the water level. From July to November 2019, the phytoplankton community structure in the water around the suspended beds was continually monitored, and the effects of the submerged plants present in the suspended beds on the phytoplankton community structure in the deep-water area of the lake were studied. The results showed that Myriophyllum spicatum L. grew well in the suspended beds, with 95% survival after 60 d. The maximum biomass was reached in 55 d, and the water surface coverage reached 23%. There were 71 species of phytoplankton belonging to seven phyla in the water surrounding the suspended ecological beds. Over half (36 species) were members of Prochlorophyta, and the average density and biomass of phytoplankton gradually decreased month by month. The proportion of cyanobacteria in the community showed a downwards trend, while the proportions of other phytoplankton phyla showed upwards trends. The annual average Shannon-Wiener diversity index was 0.88, the annual average Pielou evenness index was 0.32, and the annual average Margalef richness index was 1.21. The Shannon-Wiener diversity index and Pielou's evenness index both showed increasing trends. This comprehensive analysis shows that planting submerged plants in suspended beds can improve the phytoplankton community structure of the surrounding water and increase the biodiversity of phytoplankton, making this an effective measure for restoring submerged vegetation in algae-dominated northern lakes.

（来源: JOURNAL OF FRESHWATER ECOLOGY 出版年: 2022,**DOI:** 10.1080/02705060.2022.2036646）

Dietary patterns of five freshwater fish species in a large Mediterranean lake

Vagenas, Georgios; Stoumboudi, Maria Th; Petriki, Olga; 等

The diet of five freshwater fish species of Lake Trichonis, the largest natural lake of Greece, was studied. Specifically, the studied species were Atherina boyeri, Luciobarbus albanicus, Leucos panosi, Scardinius acarnanicus and Tropidophoxinellus hellenicus. The diet analysis was based on stomach content analysis of seasonal samples collected during 2019 by experimental Nordic multimesh gillnets. Additionally, trophic indices were estimated (Shannon-Wiener, Levins', Schoener, Trophic level) so as to investigate each species' feeding diversity, trophic niche breadth, trophic level as well as their trophic competition and overlap. Moreover, the annual and the seasonal relative condition factor was estimated. The diet analysis indicated a tendency of the studied species to omnivorous feeding strategy and a seasonal fluctuation in their diet composition. In addition, the estimated trophic indices revealed similar feeding behavior and significant diet overlap between species, suggesting narrow partitioning of the food resources. However, the relative condition factor ranged between 0.973 and 1.041, indicating a state of wellbeing for the fish species and possibly sufficient food availability.

（来源: JOURNAL OF FRESHWATER ECOLOGY 出版年: 2022, **DOI:** 10.1080/02705060.2022.2034674）

Spatial and seasonal dynamics of phytoplankton groups and its relationship with environmental variables in Lake Okeechobee, USA

Ma, Chengxue; Li, Ziyu; Mwagona, Patteson Chula; 等

The concept of phytoplankton functional groups was used to assess phytoplankton community structure in an attempt to better understand their spatial and seasonal variation in Lake Okeechobee, USA. Samples were collected for analyses during summer and winter. 23 phytoplankton functional groups were identified among 102 species, of which 9 groups (H1, M, C, MP, Y, S1, J, X1 and X2) were categorized as dominant. Y represented by Cryptomonas ovate and H1, represented by Anabaena circinalis and Anabaena variabilis, were dominant in some sites in summer corresponding to higher temperatures. In winter, the biomass of the functional groups was dominated by chlorophyta group X2 corresponding to lower temperatures, and relatively high nutrients. Redundancy analysis (RDA) with Monte Carlo test revealed that water temperature (WT), TP, and TN were the most dominant environmental variables which influenced phytoplankton functional group distribution in Lake Okeechobee. Functional group H1 was associated with TN, pH, TP and WT. Similarly, functional group Y was significantly positively correlated with TN, TP and WT but negatively correlated with TN/TP ratios. This study reveals the importance of physical-chemical variables across a spatial and seasonal gradient, in structuring phytoplankton functional groups, and consequently in the assessment of environmental status of the lake.

（来源: JOURNAL OF FRESHWATER ECOLOGY 出版年: 2022,**DOI:** 10.1080/02705060.2022.2032852）

Seasonal Patterns of Mixing and Arsenic Distribution in a Shallow Urban Lake

Fung, Samantha R.; Hull, Erin A.; Burkart, Kenneth; 等

Arsenic, a neurotoxin and carcinogen, is a legacy contaminant in the sediments of many urban lakes and poses health risks to aquatic ecosystems and lake users. Arsenic uptake into the aquatic food web is enhanced in shallow, polymictic lakes compared to deep, seasonally stratified lakes. We present the results of a 17-month field study in Lake Killarney, a shallow, urban lake in Federal Way, Washington, USA, which examines the physical and biogeochemical mechanisms controlling arsenic mobilization and transport from sediment into lake waters, a prerequisite for arsenic uptake into the food web. In Lake Killarney, arsenic mobilization and transport into bottom waters occurred only when stratified conditions and elevated temperatures facilitated deoxygenation of bottom waters. Frequency of lake mixing varied seasonally and controlled the vertical distribution of arsenic in the water column. Convective mixing was the main contributor to elevated vertical turbulent intensity in the water column during periods of high arsenic mobilization, and thus to the upwards transport of arsenic from bottom waters. Maximum near-surface arsenic occurred when the lakebed sediment temperature was elevated and the water column was overturning frequently. This work clarifies the mechanisms that contribute to vertical arsenic transport in shallow lakes and provides a basis for identifying contaminated systems with the physical and biogeochemical conditions that promote transport of arsenic into near-surface water.

（来源: WATER RESOURCES RESEARCH 出版年: 2022,**DOI:** 10.1029/2022WR032564）

Mixing Dynamics at the Large Confluence Between the Yangtze River and Poyang Lake

Xu, Lei; Yuan, Saiyu; Tang, Hongwu; 等

Mixing processes downstream of river confluences impacts the ecology and the related environmental management of river networks. A clear understanding of such processes is challenging, especially for confluences having width-to-depth ratios larger than 100, due to the limited available field data. In this study, four field surveys based on hydro-acoustic and conductivity measurements were conducted near the confluence between the Yangtze River and the Poyang Lake, which are the largest river and freshwater lake in China, respectively. It was found that mixing dynamics at the confluence were controlled by a complex interaction among the momentum flux ratio, secondary flow and the lock-exchange flow associated to the density contrast between the two tributaries. Slow mixing was observed during high-flow conditions that generated dual counter-rotating secondary cells, with the downwelling flow acting as a barrier in the post-confluence channel. In contrast, more rapid mixing was observed during low-flow conditions when only a single channel-scale secondary flow was identified. The mixing processes were also affected by the lock-exchange flow associated to the density difference between the two confluent flows. Such lock-exchange enhanced mixing when the Yangtze River waters had higher temperature, that is, lower density than that of the Poyang Lake. In low flow condition, the penetration of the much larger momentum flux of Yangtze River created a two-layers structure with the contribution of the density difference, which further enhanced the curvature-induced helicity. The findings from the present study improve our current understanding of mixing dynamics in large river confluences.

（来源: WATER RESOURCES RESEARCH 出版年: 2022,**DOI:** 10.1029/2022WR032195）

Climatic impacts on an Arctic lake since 1300 AD: a multi-proxy lake sediment reconstruction from Prins Karls Forland, Svalbard

Orme, L. C.; Lind, E. M.; Holm, T. M.;等

On the remote Arctic archipelago of Svalbard, there is increasing evidence of environmental impacts from climate change. The analysis of lake sedimentary records can be used to assess how strongly these recent changes have altered lake ecosystems. Sediments deposited during the last millennium from Lake Blokkvatnet, Prins Karls Forland, were analysed using a multiproxy approach, including stable isotope and X-ray fluorescence analysis. The results were interpreted as reflecting variability of (1) soil organic matter inwash, and potentially catchment and lake primary production, and (2) catchment weathering and erosion. Organic content began increasing after 1920 AD to the present, likely in response to warming. Earlier peaks of a similar magnitude occurred on three occasions since 1300 AD, with evidence indicating that these may have coincided with multidecadal-scale periods with higher temperatures, reduced sea ice and negative phases of the North Atlantic Oscillation. Catchment weathering and fluvial erosion began to increase around 1800 AD and peaked during the early twentieth century, potentially due to rising temperatures in autumn and winter causing increased liquid water availability. The records suggest that similar levels of erosion and weathering occurred between approximately 1300 and 1600 AD, spanning the transition from the Medieval Climate Anomaly to the Little Ice Age.

（来源: JOURNAL OF PALEOLIMNOLOGY 出版年: 2022,**DOI:** 10.1007/s10933-022-00271-8）

Neoglacial lake-ecosystem changes above and below the subarctic Fennoscandian treeline inferred from changes in diatom functional groups

Rantala, Marttiina, V; Kivila, E. Henriikka; Meyer-Jacob, Carsten;等

Algal communities act as sensitive indicators of past and present climate effects on northern lakes, but their responses can vary considerably between ecosystems. Functional trait-based approaches may help us better understand the nature of the diverse biotic responses and their underlying ecosystem changes. We explored patterns in diatom (Bacillariophyceae) growth forms and species composition during the Neoglacial in two shallow lakes typical of subarctic regions, including a dark-colored woodland lake and a clear tundra lake. Sediment carbon and nitrogen elemental and isotope biogeochemistry and spectral indices were used to track broadscale changes in lake productivity, the inflow of organic carbon from land, and benthic substratum over the past three millennia. The biogeochemical indices tracked declines in land-lake connectivity as well as lake-water and sediment organic enrichment above and below the subarctic treeline driven by Neoglacial cooling. This broadscale environmental transition was intercepted by periods of elevated primary production associated with transient Neoglacial warm anomalies and, in particular, the twentieth century warming. Although the Neoglacial development of the lakes showed conspicuous similarities, diatom functional and taxonomic responses were not uniform between the lakes pointing to intrinsic differences in the development of benthic habitats and underwater-light regimes. Many of the observed biotic shifts aligned with expectations based on earlier research linking diatom functional traits to changing light and organic levels but the results also point to further research needs, particularly to better differentiate the individual and interactive effects of substratum and light. Despite distinct anthropogenic imprints in the biogeochemical record, the scale of human impact on the lakes' biota has not, as yet, been profound, but the changes are nonetheless clear when compared to the previous three millennia of natural lake development.

（来源: JOURNAL OF PALEOLIMNOLOGY 出版年: 2022,**DOI:** 10.1007/s10933-022-00272-7）

The temporal and spatial variation in morphospecies, size and viability of Microcystis colonies in Lake Taihu

Yang, Zhen; Shi, Xiaoli; Yu, Yang;等

Microcystis has been the dominant bloom-forming cyanobacterial population in Lake Taihu over the past two decades. To illustrate the temporal and spatial variation in the main colony characteristics for Microcystis and their key environmental factors in Lake Taihu, an annual investigation of the size, morphospecies and viability (the viable cell rate) of Microcystis colonies was performed in this study from 2020 to 2021. The average colony diameter ranged from 81.12 to 499.54 mu m at all sites during this investigation. The average colony diameter of the whole lake in spring and in late autumn to early winter was higher than that in other times. Microcystis flos-quae, Microcystis aeruginosa, Microcystis novacekii and Microcystis wesenbergii were the main dominant morphotypes, which was mainly affected by pH, TDP and temperature. Although no significant correlation was found between colony viability and environmental factors, the temporal difference in colony viability was remarkable. Colony viability in autumn (mainly October and November), spring (March and April), and July was lower than that in other times.

（来源: AQUATIC ECOLOGY 出版年: 2022,**DOI:** 10.1007/s10452-022-09992-4）

Response of the cellular components to environmental factors indicates limiting factors of Microcystis in Lake Taihu

Tian, Yaqi; Deng, Jianming; Li, Ming

Studying the influence of environmental factors on the growth and physiological state of cyanobacteria is an important basis for understanding the formation of cyanobacteria content. This study selected Microcystis aeruginosa as an example, using algal pigment and fatty acid composition to reflect the physiological state of Microcystis, and analyzed the effects of environmental changes on the basic physiological indicators of Microcystis cells. The results showed that an increase in light strength caused the ratio of Chlorophyll a to proteins to decrease and then increase, but has little effect on fatty acids. Increasing the temperature caused Microcystis cells to increase photosynthesis pigments and polysaccharides to proteins ratio and caused fatty acid Palmitic acid C16:0 to decrease and then increase, as opposed to linoleic acid gamma-C18:3. When the N:P ratio was 9.4, an increase in N concentration caused the Chlorophyll a to PR ratio to increase, and PS, TOC, beta-carotene and zeaxanthin to PR ratio decrease. At P = 1.7 mg L-1, an increase N:P ratio promoted photosynthetic pigmentation of algae, which increased the PS to PR ratio. During autumn and winter, the fatty acids of Lake Taihu Microcystis cells were mostly C16:0 and C18:1, of which C16:0 changed most significantly during the winter period, showing a trend of decreasing first and then increasing later. Cluster analysis and the comparison of laboratory data found that the limiting factors affecting the growth of Lake Taihu Microcystis during this period were mainly temperature and nitrogen concentrations.

（来源: AQUATIC ECOLOGY 出版年: 2022,**DOI:** 10.1007/s10452-022-09997-z）

Influence of Potamogeton crispus harvesting on phosphorus composition of Lake Yimeng

Wang, Lizhi; Wu, Xiyuan; Song, Hongli; 等

Harvesting is an important method used to control the overproduction of Potamogeton crispus in lakes. A three-year comparative field study was performed in a eutrophic lake (harvested area) and its connected

lake (non-harvested area) to determine the effects of harvesting on the phosphorus (P) composition and environmental factors in the water and sediment. Results revealed that harvesting significantly reduced the dissolved total P and dissolved organic P (DOP) and increased the alkaline phosphatase activity and particulate P (PP) in the water. No significant differences were detected in the water total P (TP), soluble reactive P, chlorophyll-a, pH, and dissolved oxygen between the harvested and non-harvested areas. Sediment TP and organic P (OP) were significantly reduced in the harvested area. Harvesting changed the P composition in the water. In the non-harvested area, P was mainly formed by DOP (40%) in the water body, while in the harvested area, PP was the main water component (47%). Harvesting increased the proportion of inorganic P (IP) in the sediment and decreased the proportion of OP. In the water, the IP to TP ratio in the non-harvested and harvested areas were 58.26% and 63.51%, respectively. Our results showed that harvesting changed the P composition in the water and sediment. In the harvesting of submerged vegetation, our results can serve as a reference for the management of vegetation-rich lakes.

（来源: SCIENTIFIC REPORTS 出版年: 2022,**DOI:** 10.1038/s41598-022-22484-7）

Active water management brings possibility restoration to degraded lakes in dryland regions: a case study of Lop Nur, China

Lu, Shanlong; Wang, Yong; Zhou, Jinfeng;等

Protecting and restoring the degraded arid lakes are globally urgent issues. We document a potential recovery of the dried salt-lake, Lop Nur called the Sea of Death which is located at the terminus of the largest inland basin in China, the Tarim River Basin. The changes and relationship of surface water with climate parameters and groundwater in the basin over the last 30 years are analyzed, by using satellite remote sensing and land data assimilation products. We find that with increased surface water in the basin, the groundwater level in Lop Nur began to show an obvious positive response in 2015; and the rate of decline of the groundwater level is slowing down. We argue that after a balance is achieved between regional groundwater recharge and evapotranspiration, the Lop Nur ecosystem will gradually recover. This study shows an encouraging case for the protection and restoration of degraded lakes in dryland regions around the world.

（来源: SCIENTIFIC REPORTS 出版年: 2022,**DOI:** 10.1038/s41598-022-23462-9）

Drivers of revitalization in Great Lakes coastal communities

Nixon, Rebecca; Carlton, J. Stuart; Ma, Zhao

Sediment remediation and habitat restoration projects have been increasingly employed along the coast of the Great Lakes to improve environmental quality since the designation of 43 highly degraded Areas of Concern (AOCs) by the 1987 Great Lakes Water Quality Agreement between the U.S. and Canada. Improvements in water quality, habitat, and other environmental conditions can also support community wellbeing and revitalization; however, the mechanisms that support these connections are relatively unclear. We address this gap through a case study of three AOCs near Lake Michigan: 1) Grand Calumet River; 2) White Lake, and 3) Muskegon Lake. By analyzing secondary data and planning docu-ments, we found that alongside environmental cleanup, anchor institutions, housing and economic devel-opment, and local events drive revitalization. Our research also illustrates that, rather than acting as discrete processes, environmental cleanup and revitalization drivers overlap in time and space. Finally, our research reveals a high level of variation within and across AOCs in terms of diverse socioeconomic contexts, planning capacities, and existing partnerships. Together, our findings point to the need for

col-laborative and inclusive planning processes that account for the heterogeneity present within and across AOCs to simultaneously support remediation, restoration, and revitalization and to sustain continued revitalization in AOC communities after delisting.

（来源: JOURNAL OF GREAT LAKES RESEARCH 出版年: 2022,**DOI:** 10.1016/j.jglr.2022.03.008）

Building a research network to better understand climate governance in the Great Lakes

Bergstrom, Ryan; Johnson, Lucinda B.; Sterner, Robert W.;等

Climate-driven disturbances threaten the sustainability of coastal communities in the Great Lakes Basin. Because such disturbances are unpredictable, their magnitude, number and intensity are changing, and they occur at varying temporal and spatial scales. Consequently, communities struggle to respond in effective ways. The expected intensification of climate-driven disturbances will require that community capacity and governance structures match the spatial and temporal scales of these disturbances, as the most sustainable social and economic systems will be those that can respond at similar frequencies to key natural system drivers. The Climate Governance Variability in the Great Lakes Research Coordination Network (CGVG-RCN) was recently established to address questions about the relationship between climate-driven disturbances and community response. The objective of this short communication is to introduce the ideas behind the CGVG-RCN, outline its goals, and facilitate engagements and collaboration with social and natural scientists interested in social-ecological systems in the Great Lakes Basin.

（来源: JOURNAL OF GREAT LAKES RESEARCH 出版年: 2022,**DOI:** 10.1016/j.jglr.2022.02.010）

Defining coastal resilience in the Great Lakes: A systematic review and critical comparison

Dobie, Sarah; Doran, Patrick J.; Norton, Richard K.;等

There are many definitions of resilience, and a growing body of literature suggests that how resilience is defined may have significant consequences for planning and policy making outcomes. In the Great Lakes Region, resilience is gaining increasing attention from planners and policy makers in response to more frequent disruptions to social-ecological systems and built environments from coastal hazards. There has not yet been extensive research into how resilience is being defined in practice and how these definitions can affect geographies of risk and resilience and contribute to varying ecological, social, cultural, political, and economic outcomes. In this paper, we analyzed how stakeholders engaged in natural resource management activities within the Laurentian Great Lakes coastal environment define resilience and discuss the implications for planning and policy making through a critical geography and critical space lens. We systematically reviewed gray literature published by these stakeholders to document definitions of resilience. We then applied a 5Ws + H of resilience framework-resilience for whom, what, where, when, why, and how-to develop descriptive statistics and qualitatively analyze the definitions, considering the potential implications for ongoing regional planning and policy making efforts. Our analysis revealed a large degree of variation in the definitions, although we note two distinct gaps. We discuss how these gaps could affect ongoing regional planning and policy making efforts, and we lay out four research needs to inform planning and policy making going forward.

（来源: JOURNAL OF GREAT LAKES RESEARCH 出版年: 2022,**DOI:** 10.1016/j.jglr.2022.08.001）

Dolichospermum blooms in Lake Superior: DNA-based approach provides insight to the past, present and future of blooms

Sheik, Cody S.; Natwora, Kaela E.; Alexson, Elizabeth E.;等

Cyanobacterial blooms are increasing in frequency, duration, and severity globally in freshwater ecosys-tems. The Laurentian Great Lakes are prone to toxin-producing cyanobacterial blooms and have experi-enced annually recurring blooms. Because of its oligotrophic nature, Lake Superior has been relatively free of bloom occurrences. However, in recent years, Dolichospermum blooms have occurred with increas-ing frequency, especially in the western arm. During a Dolichospermum bloom in 2018, opportunistic samples were collected from the offshore bloom and investigated with shotgun metagenomics. We iden-tified a near-complete Dolichospermum genome that is highly similar to genomes from cultures recovered in Lakes Erie and Ontario. The genomes from the Laurentian Great Lakes are typified by their putative ability to produce a suite of secondary metabolites like anabaenopeptin, but not toxins like microcystin. Additionally, we recovered a Dolichospermum lemmermannii 16S rRNA gene from the bloom and using datasets collected from the epilimnion and sediments in Lake Superior show this organism is ubiquitous and that several strains may exist. While there is much to learn about Lake Superior cyanobacterial bloom development and triggers, understanding this organism is endemic to the region, what its genome is cap-able of and that specific strains may have provenance within the lake provides a distinct ecological basis for understanding and working towards a predictive framework for future blooms.

（来源: JOURNAL OF GREAT LAKES RESEARCH 出版年: 2022,**DOI:** 10.1016/j.jglr.2022.08.002）

Toward science-informed public policy: A conceptual framework for contributing to and studying Great Lakes coastal shoreland management

Norton, Richard K.

Great Lakes coastal shorelands encompass valuable environmental and social resources. Most are privately owned. Governments play an important role in managing the use of those shorelands to ensure adequate conservation of the natural and social benefits they provide. Scientists have demonstrated that imprudent land uses are yielding significant ecological harms and increased risks to coastal shorelands, and yet those uses persist. Public coastal shoreland management appears to be poorly informed by the best available science. In addition to generating good science, scientists are themselves members of the public well-positioned to contribute to improved coastal shoreland management. Two prominent proposals for doing so include calls for scientists, first, to better communicate their knowledge through direct engagement with decision-makers ('contributing to') and second, to co-produce the knowledge that decision-makers require by participating in multi-disciplinary, community-engaged research ('studying'). For either endeavor, scientists need to understand public coastal shoreland management processes to engage effectively with them. Drawing from multiple literatures, this paper presents a conceptual framework to assist scientists working to contextualize and more effectively convey the knowledge they have, or to engage in research designed to co-produce knowledge, in order to better promote science-informed public coastal shoreland management. The framework is set within the institutional arrangements that structure coastal management processes, and it highlights the ways in which key decision-maker attributes-their collective knowledge, capacities, and commitments-influence

decision-making actions and outputs. While situated specifically within the context of coastal management, the framework is adaptable to other policy arenas more broadly.

（来源: JOURNAL OF GREAT LAKES RESEARCH 出版年: 2022,**DOI:** 10.1016/j.jglr.2022.07.003）

Using 223Ra and 224Ra to estimate discharges of groundwater and associated nutrients into southeast of Qinghai Lake, in Qinghai-Tibet Plateau

Su, Weigang; Ma, Yujun; Lu, Xiaohang;等

With its important geographical location and status as the largest saltwater body in China, Qinghai Lake plays a vital role in the ecological environment of the northeastern part of the Qinghai-Tibet Plateau. Due to climate change and the subsequent adjustment of Qinghai Lake's tourism policy, it is necessary to understand groundwater discharges in southeast of Qinghai lake both for ecological protection and risk prevention. This study used radium isotopes 223Ra and 224Ra to trace groundwater discharges and nutri-ents carried into the lake. The spatial characteristics of Ra isotopes with greater activity in the upper and bottom layers in the lake indicated that they were influenced by inputs of shallow groundwater and dif-fusion from sediments. The average 224Ra diffusion flux of the sediments in the Lake was 33.54 dpm m^{-2} d^{-1}. Based on the 224Ra mass balance model, the discharge flux of shallow groundwater in this region was estimated to be 3.49 x 10^6 ti 3.68 x 10^6 m^3 d^{-1}. The $PO_4^{3-}$and SiO_2 fluxes carried into the southeastern of the lake by groundwater were 1.78 x 10^{11} ti 1.88 x 10^{11} mg/y and 2.22 x 10^{12} ti 2.34 x 10^{12} mg/y, respectively. It is thus essential to monitor shallow groundwater discharge into Qinghai Lake for the pro-tection of the water environment and prevention of potential ecological risks.

（来源: JOURNAL OF GREAT LAKES RESEARCH 出版年: 2022,**DOI:** 10.1016/j.jglr.2022.07.007）

Severe drought changes the soil bacterial community in wetland ecosystem: Evidence from the largest freshwater lake wetland in China

Zhao, Jun; Shu, Wang; Wang, Lachun; 等

The Poyang Lake, the largest freshwater lake in China, is subject to drastic seasonal hydrological fluctuations due to the global climate change and human activities, resulting in the unclear impact of soil bacterial communities undergoing severe drought pressure. To elucidate this, soil samples were collected in Phragmites, Carex, and Phalaris, and were incubated in the laboratory under three moisture levels: 30% WHC (maximum water-hold capacity) representing severe drought, 50% WHC representing moderate drought, and 80% WHC representing suitable moisture conditions. Soil bacterial communities were profiled by the 16 S rRNA gene using the Illumina high-throughput sequencing technique. The results showed that the Shannon-Wiener index of bacterial com-munities decreased with the decrease of soil moisture. The Chao1 index decreased with the decrease of soil moisture in the Carex and Phalaris zone soils, while the index first decreased and then increased in the Phrag-mites zone soil. The Shannon-Wiener index was significantly different among the three dry-wet conditions ($p = 0.017$), whereas the Chao1 index was not ($p = 0.813$). Drought altered the relative abundance of different bacterial phyla. With the decrease of soil moisture, the relative abundance of Actinobacteria increased, whereas the relative abundance of Proteobacteria, Chloroflexi, Acidobacteria, and Nitrospirae decreased. LEfSe analysis showed that the number of differential species in the soil of different vegetation zones ($n = 57$) was significantly higher than the number of differential species under different drought conditions (n

= 13). Overall, the differ-ence of soil properties in different vegetation zones has a greater effect on the bacterial community structure than that of different drought conditions in Poyang Lake wetland. This study enriched our knowledge of the drought conditions impact of bacterial communities on server drought lake ecosystems.

（来源: LIMNOLOGICA 出版年: 2022,**DOI:**10.1016/j.limno.2022.126023）

Ecological responses of the diatom species Asterionella formosa to climate change and resource availability in a shallow eutrophic lake of Chinese Loess Plateau

Zhang, Xiaosen; Xu, Xinyu; Su, Ling; 等

Diatoms have long been recognized as strong ecological indicators for climate and environmental chang-es. Asterionella formosa Hassall is a cosmopolitan diatom species around the world, but its ecological preferences are still unclear and its palaeolimnological interpretations are strongly disputed. This species is often considered to be driven by nutrient enrichment, whereas it was recently proposed that the increasing abundance of this species is linked to warming-induced lake thermal stratification. To improve its ecological interpretation, we examine the possible driving factors of this species through diatom seasonal monitoring in an alpine, shallow and eutrophic lake (Lake Mayinghai) on the Chinese Loess Plateau. Our data show that the compositional dominance of A. formosa in the late-autumn and winter months indicates that this species can tolerate both mixing and ice-covered stable water conditions and further suggests that it has a preference to low light availability. The dominance of this species is not associated with an increase in nutrients, and does not support that this species can be used as an indicator of nutrient enrichment. However, given low diatom production in the cold season, increased lake thermal stability in the growing season induced by warming is a more probable explanation, and it is likely that a eutrophic, turbid condition or an oligotrophic, other algae-dominant low-light condition may be a requisite for its interpretation as a signal of warming.

（来源: FUNDAMENTAL AND APPLIED LIMNOLOGY 出版年: 2022,**DOI:** 10.1127/fal/2022/1450）

A meta-analysis of environmental responses to freshwater ecosystem restoration in China (1987–2018)

Fu, Hong; Xu, Jun; Zhang, Huan;等

Understanding how abiotic and biotic components respond to aquatic ecosystem restoration is pivotal for sustainable development in the face of economic development and global environmental change. However, the post-restoration monitoring and evaluation of aquatic ecosystems across large spatial and temporal scales is underfunded or not well documented, especially outside of Europe and North America. We present a meta-analysis of abiotic and biotic indices to quantify post-restoration (2 months-13 years) effects from reported aquatic restoration projects throughout the China-mainland, incorporating 39 lentic and 36 lotic ecosystems. Decreases in dissolved nutrients (total nitrogen, ammonia nitrogen and total phosphorus) post-restoration were rapid, but tended to slow down after about 9.3 years. Response ratios summarizing biodiversity responses (incorporating phytoplankton, invertebrates, vascular plants, fish and birds) typically lagged behind abiotic changes, suggesting longer timescales are needed for biotic indices to recover. Time since restoration interacted with lentic project size showing that, even with the same proportional efforts of restoration, larger lentic ecosystems responded much more slowly than smaller ones. Spatial heterogeneity, reflecting the effects of different restoration approaches (e.g., sewage

interception, polluted sediment dredging, artificial wetlands, etc.), had a significantly stronger effect on biotic than abiotic indices, particularly in rivers compared to standing waters. This reflects the complexity of fluvial ecosystem dynamics and hints at a limitation in the reinstatement of ecological processes in these systems to overcome issues such as dispersal limitations. Overall, the different timelines and processes by which abiotic and biotic indices recover after restoration should be taken into account when defining restoration targets and monitoring programs. Our study illustrates the value of long-term aquatic ecosystem monitoring, especially in China given the scale and magnitude of ongoing restoration investments in the country.

（来源：ENVIRONMENTAL POLLUTION 出版年: 2022, **DOI:** 10.1016/j.envpol.2022.120589）

Environmental variability in aquatic ecosystems: Avenues for future multifactorial experiments

Gerhard, Miriam; Koussoroplis, Apostolos-Manuel; Raatz, Michael; 等

The relevance of considering environmental variability for understanding and predicting biological responses to environmental changes has resulted in a recent surge in variability-focused ecological research. However, integration of findings that emerge across studies and identification of remaining knowledge gaps in aquatic ecosystems remain critical. Here, we address these aspects by: (1) summarizing relevant terms of variability research including the components (characteristics) of variability and key interactions when considering multiple environmental factors; (2) identifying conceptual frameworks for understanding the consequences of environmental variability in single and multi-factorial scenarios; (3) highlighting challenges for bridging theoretical and experimental studies involving transitioning from simple to more complex scenarios; (4) proposing improved approaches to overcome current mismatches between theoretical predictions and experimental observations; and (5) providing a guide for designing integrated experiments across multiple scales, degrees of control, and complexity in light of their specific strengths and limitations.

（来源：LIMNOLOGY AND OCEANOGRAPHY LETTERS 出版年: 2022, **DOI:** 10.1002/lol2.10286）

Microplastics in the Great Lakes: Environmental, Health, and Socioeconomic Implications and Future Directions

Fuschi, Claire; Pu, Haihui; MacDonell, Margaret;等

Microplastics (MPs) are tiny pieces of plastic (<5 mm) that have been manufactured, shed from textiles, or formed as the degradation products of macroplastics. They can be taken up by aquatic organisms, leading to their incorporation into the food chain. Humans can consume MPs from fish as well as other impacted sources including bottled and tap water. MPs may pose risks to exposed organisms, and they can also act as vectors carrying additional adsorbed chemical pollutants and pathogens. MPs are an especially important focus regarding the Great Lakes because plastics comprise most of the litter, and the Great Lakes serve as a source of drinking water for 40 million people. This perspective summarizes the current state of MP pollution in the Great Lakes and potential risks posed to the environment, wildlife, and humans. A survey of detection, separation, and quantification methods is included. Potential remedies are explored, focusing on policy, human behavior, and the goal of a circular economy. Further research directions include standardizing detection and removal methods, assessing the health risk of MPs in the Great Lakes, and evaluating mitigation options.

（来源: ACS SUSTAINABLE CHEMISTRY & ENGINE 出版年: 2022,**DOI:** 10.1021/acssuschemeng.2c028962）

Evolving geographical gross primary productivity patterns in global lake systems and controlling mechanisms of associated phytoplankton communities since the 1950s

Junjie Jia ; Yang Gao; Boqiang Qin;等

In recent decades, anthropogenically-driven climate change has affected phytoplankton growth and has widened the differences observed among the gross primary productivity of waterbodies (WGPP) in global lake systems. Results from this study showed that the range of WGPP increased over time (from 1950 to 2020). However, the median WGPP of global inland lake systems has gradually and significantly decreased. On a geographical scale, the geographical distribution WGPP pattern was high in low- to mid-latitudinal regions and low in highlatitudinal regions. This study found that chrysophytes mainly control WGPP in high-latitudinal regions while diatoms, cyanobacteria, and chlorophytes are dominant in low-latitudinal regions. Additionally, dominant and sub-dominant phytoplankton communities contribute the most to WGPP. Under extreme environmental conditions, algae must strengthen its capacity to adapt to the burgeoning environmental conditions of global lake systems while gradually evolving to survive. Accordingly, regulating environmental conditions to promote phytoplankton community diversity and to accelerate community competition will play an important role in maintaining the ecological balance, environmental health and carbon cycle of global lake systems.

（来源: Earth-Science Reviews 出版年: 2022,**DOI:** 10.1016/j.earscirev.2022.104221）

Mechanisms Controlling Water-Level Variations in the Middle Yangtze River Following the Operation of the Three Gorges Dam

Yong Hu; Dongfeng Li; Jinyun Deng;等

Understanding the mechanisms controlling downstream water-level variations after the operation of the Three Gorges Dam is important for riverine flood and drought management. However, our quantitative understanding of the multiple controls of river morphology, vegetation, and floodplain resistance on water levels in the Middle Yangtze River (MYR) remains limited. Here, we analyze changes in river channels and floodplain resistance in the MYR using 450 cross-sectional profiles as well as data on discharge, water levels, sediment, and satellite images from 2003 to 2015. Results show an overall decline in low-flow water-levels (at a given small discharge) due to severe incisions of low-flow channels caused by a sharp reduction of~90% in sediment loads from 1950–2002 to 2003–2020. In contrast, high-flow water-levels (at a given large discharge) display minor changes. Our analysis shows that the notably increased floodplain resistance due to vegetation growth is likely the dominant factor elevating flood water-levels, followed by riverbed coarsening and greater fluctuations in the river longitudinal profiles. Our findings further the understanding of downstream geomorphic response to dam operation and their impacts on water levels and have important implications for riverine flood management in dammed river systems.

（来源: Water Resources Research 出版年: 2022,**DOI:** 10.1029/2022WR032338）

Changes of total and artificial water bodies in inland China over the past three decades

Yinuo Zhu; Aizhong Ye; Yuhang Zhang

As an important surface water resource that can be directly used, water bodies (WBs) have a non-negligible impact on human life, production and maintaining ecological balance. Over the past few

decades, how many WB have changed to different degrees due to climate change, dam construction and other factors? Using the highresolution WB mask dataset and dam point data, the study distinguished artificial and natural WBs, calculated their spatiotemporal changes, and quantified climatic and human contributions in 17 basins in inland China during 1987–2020. The results show WBs exhibited a spatial pattern of contraction in the northeast and expansion in the southwest in inland China. The total, artificial and natural area of inland WBs in China increased by 38.8%, 32.3%, 40.8% from 1987 to 2020, respectively. In the western basins of China such as Inland rivers in Northern Tibet (61%), Upper Yellow River (61%), Upper Yangtze River (52%), Inland rivers in Xinjiang (51%), climate change dominates the increase of WBs. While in the eastern basins such as the Middle and Lower Yangtze River (60.84%), Lower Yangtze River (60.53%), and Songhua basins (52.66%), dam construction is the main reason for the area change in WBs. The analysis of the spatiotemporal evolution of WBs in inland China in the past three decades and the quantification of climate and human contributions are of great significance for the rational development and sustainable use of water resources.

（来源: Journal of Hydrology 出版年: 2022,**DOI:** 10.1016/j.jhydrol.2022.128344）

Functional dynamics of phytoplankton assemblages in hypertrophic lakes: Functional- and species diversity is highly resistant to cyanobacterial blooms

Eniko T-Krasznai；Peter Torok；Gabor Borics；等

Under increasing pressure of climatic change and anthropogenic eutrophication, water blooms, i.e. the formation of high phytoplankton biomass of a single or a few species, have become more and more frequent in lake ecosystems that is caused mostly by Cyanobacteria. The dynamics of phytoplankton under a cyanobacterial pressure may provide important information about what a competitive advantage of Cyanobacteria have over eukaryotic microalgae. The research, therefore focused on the relationship between cyanobacterial blooms and the accompanying species in hypertrophic shallow lakes where nutrients are in excess. The following hypotheses were selected for testing: i) Cyanobacterial blooms negatively affect the species richness and diversity of phytoplankton assemblages in the studied hypertrophic lakes. ii) Cyanobacterial blooms negatively affect the multi-trait functional diversity of phytoplankton assemblages in the studied hypertrophic lakes. iii) The formation of a cyanobacterial bloom causes a shift in the species and trait composition of phytoplankton assemblages. It was found that the species diversity of non-cyanobacterial assemblages was not affected negatively by increasing density of Cyanobacteria. Cyanobacterial biomass negatively affected the functional richness and functional dispersion of the assemblages, but both relationships were only marginally significant. Some temporal shift was detected in the community weighted mean values of width, colonial ability of accompanying microalgae, and also in flagellatedness and mixotrophic ability. We conclude that Cyanobacterial blooms basically alter dominance relations in the phytoplankton and reduce availability of light in waters. However, it does not necessarily coincide with the elimination of other taxa and reduction their species numbers or diversity. The formerly published data on the decrease in species richness can be likely explained by methodological deficiencies, which are responsible for reduced detectability of species. To better understand the seasonal dynamics and resilience of phytoplankton assemblages in hypertrophic water bodies the development of new methodologies by which diversity and succession of subordinate species can be evaluated is required.

（来源: Ecological Indicators 出版年: 2022,**DOI:** 10.1016/j.ecolind.2022.109583）

Environmental DNA study on aquatic ecosystem monitoring and management: Recent advances and prospects

Songqian Huang；Kazutoshi Yoshitake；Shugo Watabe；等

Environmental DNA (eDNA) is organismal DNA that can be detected in the environment and is derived from cellular material of organisms shed into aquatic or terrestrial environments. It can be sampled and monitored using molecular methods, which is important for the early detection of invasive and native species as well as the discovery of rare and cryptic species. While few reviews have summarized the latest findings on eDNA for most aquatic animal categories in the aquatic ecosystem, especially for aquatic eDNA processing and application. In the present review, we first performed a bibliometric network analysis of eDNA studies on aquatic animals. Subsequently, we summarized the abiotic and biotic factors affecting aquatic eDNA occurrence. We also systematically discussed the relevant experiments and analyses of aquatic eDNA from various aquatic organisms, including fish, molluscans, crustaceans, amphibians, and reptiles. Subsequently, we discussed the major achievements of eDNA application in studies on the aquatic ecosystem and environment. The application of eDNA will provide an entirely new paradigm for biodiversity conservation, environment monitoring, and aquatic species management at a global scale.

（来源: Journal of Environmental Management 出版年: 2022,**DOI:** 10.1016/j.jenvman.2022.116310）

A trophic cascade triggers blooms of Asterionella formosa in subtropical eutrophic Lake Taihu, China

Xia Liu；Yun Li；Ruijie Shen；等

1. The importance of trophic interactions for determining the distributions, abundances, and taxonomic compositions of organisms in ecosystems has long been studied and debated. Here we test the effect of a trophic cascade on diatom (Asterionella formosa) blooms in subtropical, eutrophic Lake Taihu, China.

2. A long-term data series (2005–2015) on planktivorous fish, zooplankton and diatoms has been analysed. Structural equation modelling is used to test our hypotheses about the influences of top-down and bottom-up forces on A. formosa.

3. Since 2009, a spring bloom of A. formosa has occurred in the lake, coinciding with a reduction of Daphnia galeata biomass and of total cladoceran biomass following a marked increase in the stock of planktivorous fish (bighead carp and silver carp). Light, phosphorus (total and soluble reactive phosphate) and silica did not act as limiting factors for the growth of A. formosa.

4. Structural equation modelling analysis showed that top-down effects of cladocerans on A. formosa biomass were more important than bottom-up effects (wind speed and soluble reactive phosphate). Although A. formosa was negatively correlated with total nitrogen, total with other inorganic nitrogen (NO3 and NH4) did not restrict the proliferation of diatom blooms after 2007. These results suggested that the substantial reduction of the Daphnia population caused a diatom bloom through a trophic cascade by planktivorous fish.

5. Our study provides new insight into the effects of trophic interactions on diatom bloom formation in natural freshwater ecosystems.

（来源: Freshwater Biology 出版年: 2022,**DOI:** 10.1111/fwb.13986）

A systematic review and quantitative meta-analysis of the relationships between driving forces and cyanobacterial blooms at global scale

Siqi Wang；Xiang Zhang；Nengcheng Chen；等

The global expansion of cyanobacterial blooms poses a major risk to the safety of freshwater resources. As a result, many explorations have been performed at a regional scale to determine the underlying impact mechanism of cyanobacterial blooms for one or several waterbodies. However, to assist water management, two questions still need to be answered quantitatively at a global scale. One is to specify which factors were often selected as the driving forces of cyanobacterial blooms, and the other is to estimate their quantitative relationships. For that, this paper applied a systematic literature review for 41 peer-reviewed studies published before May 2021 and a statistical meta26 analysis based on Pearson's or Spearman's correlation coefficients from 27 studies. These results showed that the water quality, hydraulic conditions, meteorological conditions and nutrient levels were often considered the driving forces of cyanobacterial blooms in global freshwater systems. Among these, meteorological conditions and nutrient level had the highest probability of being chosen as the driving force. In addition, knowledge of the quantitative relationships between these driving forces and cyanobacterial blooms was newly synthesized based on the correlation coefficients. The results indicated that, at a global scale, meteorological conditions were negatively related to cyanobacterial blooms, and other driving forces, such as water quality, hydraulic conditions and nutrient levels, were positively related to cyanobacterial blooms. In addition, the measurement indicators of these driving forces had diverse forms. For example, the nutrient level can be measured by the concentration of different forms of nitrogen or phosphorus, which may influence the results of the correlation analysis. Thus, a subgroup meta-analysis was necessary for the subdivided driving forces and cyanobacterial blooms, which had a better accuracy. Overall, the synthesized knowledge can help guide advanced cyanobacteria-centered water management, especially when the necessary cyanobacterial data of targeting waterbodies are inaccessible.

（来源: Environmental Research 出版年: 2022,**DOI:** 10.1016/j.envres.2022.114670）

Greenhouse gas emissions from lakes and impoundments: Upscaling in the face of global change

Siqi Wang；Xiang Zhang；Nengcheng Chen；等

Lakes and impoundments are important sources of greenhouse gases (GHG: i.e., CO_2, CH_4, N_2O), yet global emission estimates are based on regionally biased averages and elementary upscaling. We assembled the largest global dataset to date on emission rates of all three GHGs and found they covary with lake size and trophic state. Fitted models were upscaled to estimate global emission using global lake size inventories and a remotely sensed global lake productivity distribution. Traditional upscaling approaches overestimated CO_2 and N_2O emission but underestimated CH_4 by half. Our upscaled size-productivity weighted estimates (1.25–2.30 Pg of CO_2-equivalents annually) are nearly 20% of global CO_2 fossil fuel emission with 75% of the climate impact due to CH_4. Moderate global increases in eutrophication could translate to 5–40% increases in the GHG effects in the atmosphere, adding the equivalent effect of another 13% of fossil fuel combustion or an effect equal to GHG emissions from current land use change.

（来源: Limnology and Oceanography Letters 出版年: 2022,**DOI:** 10.1002/lol2.10073）

Changes in Water Chemistry Associated with Rainstorm Events Increase Carbon Emissions from the Inflowing River Mouth of a Major Drinking Water Reservoir

Yuyang Li; Yongqiang Zhou; Lei Zhou;等

Large reservoirs are hotspots for carbon emissions, and the continued input and decomposition of terrestrial dissolved organic matter (DOM) from upstream catchments is an important source of carbon emissions. Rainstorm events can cause a surge in DOM input; however, periodic sampling often fails to fully capture the impact of these discrete rainstorm events on carbon emissions. We conducted a set of frequent observations prior to and following a rainstorm event in a major reservoir Lake Qiandao (China; 580 km(2)) from June to July 2021 to investigate how rainstorms alter water chemistry and CO_2 and CH_4 emissions. We found that the mean CO_2 efflux (F CO_2) (13.2 +/- 9.3 mmol m(-)(2) d(-1)) and CH_4 efflux (F CH_4) (0.12 +/- 0.02 mmol m(-2) d(-1)) in the postrainstorm campaign were significantly higher than those in the prerainstorm campaign (-3.8 +/- 3.0 and +0.06 +/- 0.02 mmol m(-)(2) d(-)(1), respectively). F CO_2 and F CH_4 increased with increasing nitrogen and phosphorus levels, elevated DOM absorption (a(350)), specific UV absorbance SUVA(254), and terrestrial humic-like fluorescence. Furthermore, F CO_2 and F CH_4 decreased with increasing chlorophyll-a (Chl-a), dissolved oxygen (DO), and pH. A five-day laboratory anoxic bioincubation experiment further revealed a depletion of terrestrial-DOM concurrent with increased CO_2 and CH_4 production. We conclude that rainstorms boost the emission of CO_2 and CH_4 fueled by the surge and decomposition of fresh terrestrially derived biolabile DOM in this and likely many other reservoir's major inflowing river mouths.

（来源: ENVIRONMENTAL SCIENCE & TECHNOLOGY 出版年: 2022,**DOI:** 10.1021/acs.est.2c06405）

Characterization of internal phosphorus loading in the sediment of a large eutrophic lake (Lake Taihu, China)

Hongbin Yin; Man Zhang; Peng Yin;等

Lake Taihu suffers from severe algal blooms every year, which is attributed primarily to the release of sediment phosphorus (P), namely the internal P loading. However, the overall internal P loading and the P hotspots in sediment have not been fully studied. This paper presents several methods, including sequential P extraction, the use of diffusive gradient in thin film (DGT), and intact core incubation to give a detailed investigation of sediment internal P loading as well as its roles in algal dominated zones (ADZs) and grass dominated zones (GDZs) in Lake Taihu. Sediment microbial composition was also analyzed to investigate its relationship with P fractions. The results indicate that the total P and the mobile P fraction in the ADZ sediments are generally higher than those of the GDZ sediments. The percentage of sediment mobile P to TP is similar to the mobile P in their distributions. In contrast, calcium bound P accounts for most of the TP in GDZ, while mobile P contributes the most to TP in ADZ. Overall, sediment can release 256 tons of TP and 217 tons of soluble reactive phosphorus (SRP) over a period of six months in the warmer seasons. Similarly, a high concentration of DGT-measured P was observed in ADZs that are recognized as P hotspots in Lake Taihu. Sediments in ADZ and GDZ was dominated by the bacteria Firmicutes and Proteobacteria, respectively and which were closely related with mobile P and calcium bound P in sediment respectively. GZD seems to be able to retain more P in sediments, thereby reducing its contribution to of internal P loading. These results indicate that the difference in sediment composition between ADZ and GDZ affects their roles in sediment internal P loading, therefore, different management strategies should be used to combat sediment internal P loads in the two zones.

（来源: Water Research 出版年: 2022,**DOI:** 10.1016/j.watres.2022.119125）

Water level–driven agricultural nonpoint source pollution dominated the ammonia variation in China's second largest reservoir

Wang, Chao ; Zhang, Hong ; Xin, Xiaokang；等

Rainfall-runoff and water flooding are the driving mechanisms of agricultural nonpoint source pollution (ANPSP), but existing research has hardly focused on water level-driven ANPSP. Danjiangkou Reservoir was the second largest reservoir in China, and its water quality was dominated by ANPSP. This study explored the effect of water level on water quality of Danjiangkou Reservoir and aimed to provide basis for water quality man-agement of large reservoirs. The effect of water level-driven ANPSP on the concentration of reservoir ammonia was studied employing the methods of factor decomposition and multiple regression on a extensive time series data of reservoir ammonia, water level, rainfall, fertilizer usage, and inflow river ammonia. The long-term trend revealed the reservoir ammonia peaked in 2011 and the inflow river ammonia peaked in 2012 (Han River) and 2013 (Dan River), which indicated the success of point source control in the past 15 years and the dominant role of ANPSP in the reservoir ammonia in recent years. With the long-term trend series, the multiple regression results showed that 56% of the variation of the reservoir ammonia concentration was due to the water level (standardized regression coefficient 0.422), fertilizer usage (standardized regression coefficient 0.522), and inflow river ammonia (standardized regression coefficient 0.219). However, the rainfall was insignificant. The predominance of water level and fertilizer usage in explanation of the reservoir ammonia variation indicated that water level-driven ANPSP was the primary factor influencing the reservoir ammonia. The effect of water level was primarily reflected in the long-term variation of ammonia concentration rather than the seasonal variation within the year. This study showed that when compared with rainfall-driven ANPSP, water level-driven ANPSP had a greater impact on the reservoir ammonia. Water quality protection should center on the management of the water level-fluctuation zone.

（来源: ENVIRONMENTAL RESEARCH 出版年: 2022,**DOI:** 10.1016/j.envres.2022.114367）

Composition of dissolved organic matter (DOM) in lakes responds to the trophic state and phytoplankton community succession

Zhidan Wen；Yingxin Shang；Kaishan Song；等

Dissolved organic matter (DOM), a heterogeneous mixture of diverse compounds with different molecular weights, is crucial for the lake carbon cycle. The properties and concentration of DOM in lakes are closely related to anthropogenic activities, terrigenous input, and phytoplankton growth. Thus, the lake's trophic state, along with the above factors, has an important effect on DOM. We determined the DOM sources and molecular composition in six lakes along a trophic gradient during and after phytoplankton bloom by combining optical techniques and the Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR-MS). CDOM pools in eutrophic lakes may be more biologically refractory than in oligotrophic and mesotrophic lakes. Molecular formulas of DOM were positively correlated with the TSI (trophic state index) value (R-2 = 0.73), with the nitrogen-containing compounds (CHON) being the most abundant formulas in all studied lakes. Eutrophication modified the molecular formulas of DOM to have less CHO% and more heteroatom S-containing compounds (CHOS% and CHNOS%), and this was the synactic result of the anthropogenic perturbation and phytoplankton proliferation. In eutrophic lakes, summer DOM showed higher molecular lability than in autumn, which was related to the seasonal phytoplankton community succession. Although the phytoplankton-derived DOM is highly bioavailable,

we detected a simpler and more fragile phytoplankton community ecosystem in autumn, which may be accompanied by a lower phytoplankton production and metabolic activity. Therefore, we concluded that the lake eutrophication increased the allochthonous DOM accumulation along with sewage and nutrient input, and subsequently increased its release with phytoplankton bloom. Eutrophication and phytoplankton growth are accompanied by more highly unsaturated compounds, O3S+O5S compounds, and carboxylic-rich alicyclic compounds (CRAMs), which are the biotransformation product of phytoplankton-derived DOM. Eutrophication may be a potential source of refractory DOM compounds for biodegradation and photodegradation. Our results can clarify the potential role of water organic matter in the future global carbon cycle processes, considering the increasing worldwide eutrophication of inland waters.

（来源: Water Research 出版年: 2022, **DOI:** 10.1016/j.watres.2022.119073）

An absorption-based approach to improved estimates of phytoplankton biomass and net primary production

Fox, James;Kramer, Sasha ;Graff, Jason R.；等

The abundance and productivity of phytoplankton constrain energy transfer through marine food webs and the export of organic carbon to the deep ocean. Bio-optical measurements correlate well with phytoplankton carbon (C-phyto), but the effect of taxonomic variability on this relationship is still uncertain. Here, we explore how changes in phytoplankton community composition influence the relationship between the particulate backscatter coefficient (b(bp)) and C-phyto and present a new approach to estimate phytoplankton biomass more accurately using b(bp). We found that using a fixed scaling factor for the conversion of b(bp) to C-phyto could lead to the underestimation or overestimation of biomass, depending on the dominant taxonomic group in the phytoplankton community. In addition, we demonstrate how a simple ratio of absorption at two wavelengths can be used to provide a coarse approximation of phytoplankton community composition when scaling b(bp) to C-phyto,C- thereby improving the estimation of net primary production.

（来源: Limnology and Oceanography Letters 出版年: 2022,**DOI:** 10.1002/lol2.10275）

Anthropogenically driven climate and landscape change effects on inland water carbon dynamics: What have we learned and where are we going?

Rachel M. Pilla; Natalie A. Griffiths; Lianhong Gu; 等

Inland waters serve as important hydrological connections between the terrestrial landscape and oceans but are often overlooked in global carbon (C) budgets and Earth System Models. Terrestrially derived C entering inland waters from the watershed can be transported to oceans but over 83% is either buried in sediments or emitted to the atmosphere before reaching oceans. Anthropogenic pressures such as climate and landscape changes are altering the magnitude of these C fluxes in inland waters. Here, we synthesize the most recent estimates of C fluxes and the differential contributions across inland waterbody types (rivers, streams, lakes, reservoirs, and ponds), including recent measurements that incorporate improved sampling methods, small waterbodies, and dried areas. Across all inland waters, we report a global C emission estimate of 4.40 Pg C/year (95% confidence interval: 3.95–4.85 Pg C/year), representing a 13% increase from the most recent estimate. We also review the mechanisms by which the most globally widespread anthropogenically driven climate and landscape changes influence inland

water C fluxes. The majority of these drivers are expected to influence terrestrial C inputs to inland waters due to alterations in terrestrial C quality and quantity, hydrological pathways, and biogeochemical processing. We recommend four research priorities for the future study of anthropogenic alterations to inland water C fluxes: (1) before-and-after measurements of C fluxes associated with climate change events and landscape changes, (2) better quantification of C input from land, (3) improved assessment of spatial coverage and contributions of small inland waterbodies to C fluxes, and (4) integration of dried and drawdown areas to global C flux estimates. Improved measurements of inland water C fluxes and quantification of uncertainty in these estimates will be vital to understanding both terrestrial C losses and the “moving target” of inland water C emissions in response to rapid and complex anthropogenic pressures.

（来源: Global Change Biology 出版年: 2022, **DOI:** 10.1111/gcb.16324）

Quality matters: Pollution exacerbates water scarcity and sectoral output risks in China

Jinling Li; Jianxun Yang; Miaomiao Liu;等

Pollution exacerbates a region’s water scarcity by making water unfit for different uses and reducing freshwater availability. Local water scarcity may lead to economic output losses, and the risk can be transmitted to downstream sectors through reduced input supplies. Previous studies focus on quantity-based water scarcity assessment. It is still unknown how water quality constraints may amplify economic risks of local water-use sectors and distant economies. Here we introduce an integrated method and assess the impacts of both quantity and quality-based local physical water scarcity risks (LWSR) and virtual water scarcity risks (VWSR) in domestic trade system in China. We find in 2017 quality-based LWSR and VWSR in China are ~593 and ~240 billion US$. Inclusion of water pollution constraints almost doubles the risks of economic losses due to insufficient clean water supply. We then identify critical regions and sectors that are highly risky or vulnerable to the supply chains. We find water pollution makes risky VWSR exporters more centralized in a few Northern provinces where available freshwater resources are already limited, e.g. the agriculture sector in Hebei province. VWSR importers span broadly, but water pollution increases concentrations of upstream suppliers that face local water scarcity for most provinces, decreasing overall resilience of China’s domestic trade network. Our results underscore the needs to alleviate overall scarcity risks by conserving physical water resources and improving water quality simultaneously.

（来源: Water Research 出版年: 2022, **DOI:** 10.1016/j.watres.2022.119059）

Fuel from within: Can suspended phosphorus maintain algal blooms in Lake Dianchi

Zuxue Jin; Jingfu Wang; Shihao Jiang;等

Extensive algal bloom in the surface water is a pressing issue in Lake Dianchi that causes lake restoration to be difficult owing to complex and variable phosphorus (P) sources in the water column. P released from algae, suspended particles (SS), and sediment can provide sustainable P sources for algal blooms. However, little is known regarding the dynamic of P speciation in these substances from different sources. In this study, solution 31P nuclear magnetic resonance (31P NMR) and chemical sequential extraction were employed to identify P speciation in algae, SS, and sediment during different periods. Results showed that dissolved inorganic P (Pi) directly accumulated in algae in the form of

orthophosphate (ortho-P) and pyrophosphate (pyro-P). Algae preferentially utilized Pi, followed by organic P (Po) in the water column when the Pi was insufficient during growth and reproduction. The 31P NMR spectra demonstrated that ortho-P, orthophosphate monoesters (monoP), orthophosphate diesters (diester-P), and pyro-P dominated the P compounds across the samples tested. Increasing remineralization of SS mono-P driven by intense alkaline phosphatase activities was caused by increasing P needs of algae and pressure of P supply in the water column. The higher ratios of diester-P to mono-P in sediment (mean 0.55) than those in algae (mean 0.07) and SS (mean 0.11 in surface water, 0.14 in bottom water) suggested that the degradation and regeneration occurred within these P compounds during or after sedimentation. Pi content in algae during growth and reproduction was controlled by its P absorption and utilization strategies. Results of this study provide insights into the dynamic cycling of P in algae, SS, and sediment, explaining the reason for algal blooms in the surface water with low concentrations of dissolved P.

（来源: Environmental Pollution 出版年: 2022, **DOI:** 10.1016/j.envpol.2022.1199649）

Global increase in methane production under future warming of lake bottom waters

GJoachim Jansen; Richard Iestyn Woolway; Benjamin M. Kraemer; 等

Lakes are significant emitters of methane to the atmosphere, and thus are important components of the global methane budget. Methane is typically produced in lake sediments, with the rate of methane production being strongly temperature dependent. Local and regional studies highlight the risk of increasing methane production under future climate change, but a global estimate is not currently available. Here, we project changes in global lake bottom temperatures and sediment methane production rates from 1901 to 2099. By the end of the 21st century, lake bottom temperatures are projected to increase globally, by an average of 0.86–2.60°C under Representative Concentration Pathways (RCPs) 2.6–8.5, with greater warming projected at lower latitudes. This future warming of bottom waters will likely result in an increase in methane production rates of 13%–40% by the end of the century, with many low-latitude lakes experiencing an increase of up to 17 times the historical (1970–1999) global average under RCP 8.5. The projected increase in methane production will likely lead to higher emissions from lakes, although the exact magnitude of the emission increase requires more detailed regional studies.

（来源: Global Change Biology 出版年: 2022, **DOI:** 10.1111/gcb.16298）

From macrophyte to algae: Differentiated dominant processes for internal phosphorus release induced by suspended particulate matter deposition

Cheng Liu; Yiheng Du; Jicheng Zhong;等

In shallow lakes, eutrophication leads to a shift of the macrophyte-dominated clear state towards an algaedominated turbid state. Phosphorus (P) is a crucial element during this shift and is usually concentrated in the suspended particulate matter (SPM) in water. However, the dominant processes controlling internal P release in the algae- (ADA) and macrophyte-dominated (MDA) areas under the influence of P-concentrated SPM remains unclear. In this study, we conducted monthly field observations of P exchange across the sediment-water interface (SWI) with the deposition of SPM in the ADA and MDA of Lake Taihu. Results revealed that both algae- and macrophyte-originated SPM led to the

depletion of oxygen across the SWI during summer and autumn. Redox-sensitive P (Fe-P) and organic P (Org-P) were the dominant mobile P fractions in both areas. High fluxes of P across the SWI were observed in both areas during the summer and autumn. However, the processes controlling P release were quite different. In MDA, P release was mostly controlled by a traditional Fe-P dissolution process influenced by the coupled cycling of iron, sulfur, and P. In the ADA, Org-P control was intensified with the deterioration of algal bloom status, accompanied with the dissolution of Fe-P. Evidence from the current study revealed that the dominant process controlling the internal P release might gradually shift from Fe-P to a coupled process of Fe-P and Org-P with the shift of the macrophyte- to an algae-dominated state in shallow eutrophic lakes. The differentiated processes in the MDA and ADA should be given more attention during future research and management of internal P loadings in eutrophic lakes.

（来源: Water Research 出版年: 2022, **DOI:** 10.1016/j.watres.2022.119067）

Chlorophyll–total phosphorus relationships emerge from multiscale interactions from algae to catchments

Carly R. Olson; Stuart E. Jones

Chlorophyll and total phosphorus (TP) concentrations are key indicators of lake water quality and the relationship between them is a common tool for assessing lake trophic status. Despite the application of the chlorophyll–TP relationship in management settings, there is still an absence of a mechanistic understanding underlying its shape. We leveraged a process-based model that focuses primarily on biogeochemical and physiological mechanisms to develop a framework that reconciles interactions between multiscale drivers of the chlorophyll–TP relationship, such as hydrologic P loads, lake shape, and algal physiology. We found that combinations of lake shape and hydrologic P load induce broad shifts in algal limitation status that underly the shape of the chlorophyll–TP relationship. Furthermore, we highlight the importance of algal traits in controlling shifts in limitation. Our framework ties key landscape and ecosystem features to biological limitation and provides a synthetic and process-based understanding of the chlorophyll–TP relationship.

（来源: Limnology and Oceanography Letters 出版年: 2022, **DOI:** 10.1002/lol2.10281）

Fish and macroinvertebrate assemblages reveal extensive degradation of the world's rivers

Feio, Maria Joao; Hughes, Robert M.; Serra, Sonia R. Q.; 等

Rivers suffer from multiple stressors acting simultaneously on their biota, but the consequences are poorly quantified at the global scale. We evaluated the biological condition of rivers globally, including the largest proportion of countries from the Global South published to date. We gathered macroinvertebrate- and fish-based assessments from 72,275 and 37,676 sites, respectively, from 64 study regions across six continents and 45 nations. Because assessments were based on differing methods, different systems were consolidated into a 3-class system: Good, Impaired, or Severely Impaired, following common guidelines. The proportion of sites in each class by study area was calculated and each region was assigned a Koppen-Geiger climate type, Human Footprint score (addressing landscape alterations), Human Development Index (HDI) score (addressing social welfare), % rivers with good ambient water quality, % protected freshwater key biodiversity areas; and % of forest area net change rate. We found that 50% of macroinvertebrate sites and 42% of fish sites were in Good condition, whereas 21% and 29% were Severely Impaired, respectively. The poorest biological conditions occurred in Arid and Equatorial

climates and the best conditions occurred in Snow climates. Severely Impaired conditions were associated (Pearson correlation coefficient) with higher HDI scores, poorer physico-chemical water quality, and lower proportions of protected freshwater areas. Good biological conditions were associated with good water quality and increased forested areas. It is essential to implement statutory bioassessment programs in Asian, African, and South American countries, and continue them in Oceania, Europe, and North America. There is a need to invest in assessments based on fish, as there is less information globally and fish were strong indicators of degradation. Our study highlights a need to increase the extent and number of protected river catchments, preserve and restore natural forested areas in the catchments, treat wastewater discharges, and improve river connectivity.

（来源：Global Change Biology 出版年: 2022, **DOI:**10.1111/gcb.16439）

Unique microbiome in organic matter-polluted urban rivers

Liang, Zhiwei; Abdillah, Ayik; Fang, Wenwen; 等

Approximately half of the global annual production of wastewater is released untreated into aquatic environments, which results in worldwide organic matter pollution in urban rivers, especially in highly populated developing countries. Nonetheless, information on microbial community assembly and assembly-driving processes in organic matter-polluted urban rivers remains elusive. In this study, a field study based on water and sediment samples collected from 200 organic matter-polluted urban rivers of 82 cities in China and Indonesia is combined with laboratory water-sediment column experiments. Our findings demonstrate a unique microbiome in these urban rivers. Among the community assembly-regulating factors, both organic matter and geographic conditions play major roles in determining prokaryotic and eukaryotic community assemblies, especially regarding the critical role of organic matter in regulating taxonomic composition. Using a dissimilarity-overlap approach, we found universality in the dynamics of water and sediment community assembly in organic matter-polluted urban rivers, which is distinctively different from patterns in eutrophic and oligotrophic waters. The prokaryotic and eukaryotic communities are dominated by deterministic and stochastic processes, respectively. Interestingly, water prokaryotic communities showed a three-phase cyclic succession of the community assembly process before, during, and after organic matter pollution. Our study provides the first large-scale and comprehensive insight into the prokaryotic and eukaryotic community assembly in organic matter-polluted urban rivers and supports their future sustainable management.

（来源：Global Change Biology 出版年: 2022, **DOI:**10.1111/gcb.16472）

Distinct indicators of land use and hydrology characterize different aspects of riverine phytoplankton communities

Qu, Yueming; Wu, Naicheng; Guse, Bjoern; 等

Given the many threats to freshwater biodiversity, we need to be able to resolve which of the multiple stressors present in rivers are most important in driving change. Phytoplankton are a key component of the aquatic ecosystem, their abundance, species richness and functional richness are important indicators of ecosystem health. In this study, spatial variables, physiochemical conditions, water flow alterations and land use patterns were considered as the joint stressors from a lowland rural catchment. A modeling approach combining an ecohydrological model with machine learning was applied. The results implied that land use and flow regime, rather than nutrients, were most important in explaining

differences in the phytoplankton community. In particular, the percentage of water body area and medium level residential urban area were key to driving the rising phytoplankton abundance in this rural catchment. The proportion of forest and pasture area were the leading factors controlling the variations of species richness. In this case deciduous forest cover affected the species richness in a positive way, while, pasture share had a negative effect. Indicators of hydrological alteration were found to be the best predictors for the differences in functional richness. This integrated model framework was found to be suitable for analysis of complex environmental conditions in river basin management. A key message would be the significance of forest area preservation and ecohydrological restoration in maintaining both phytoplankton richness and their functional role in river ecosystems.

（来源：Science of the Total Environment 出版年: 2022, **DOI:**10.1016/j.scitotenv.2022.158209）

Human activities induce potential aquatic threats of micropollutants in Danjiangkou Reservoir, the largest artificial freshwater lake in Asia

Chen, Miao; Jin, Xiaowei; Liu, Yang; 等

Freshwater biodiversity and ecosystem services may decline because of toxicant input, and other environmental variables often co-occur with contaminants to jeopardize the freshwater ecosystem. In this study, Danjiangkou Reservoir (DJKR) in central China was selected as the target research area to investigate the impact of multiple categories of micropollutants coupled with other stressors on the reservoir ecosystem. A total of 140 samples were collected from 28 sites in DJKR, and 124 micropollutants, including pesticides, organophosphate esters (OPEs), psychoactive substances, antiviral drugs, and pharmaceutical and personal care products, were quantified. A total of 108 micropollutants were detected in the water samples, with sum concentrations ranging from 82.35 $ng.L^{-1}$ to 1436.57 $ng.L^{-1}$, and 71 of them had a detection frequency above 50%, indicating the prevailing micropollutant contamination in the reservoir. The most severe pollution and risks were observed in the tributaries of DJKR. Pesticides (neonicotinoid and triazine) and OPEs were the major contributors to the ecological risk in the reservoir. Insecticides, herbicides, and OPEs accounted for the majority of the risks to fish, algae, and invertebrates, respectively. The determined priority pollutants should be paid increased attention. Environmental variables and human activities, such as human land use, induced the potential aquatic threats of micropollutants in DJKR. Results demonstrated that micropollutant pollution was one of the dominant pressures faced by aquatic organisms and human beings, and human activities played important roles as well.

（来源：Science of the Total Environment 出版年: 2022, **DOI:**10.1016/j.scitotenv.2022.157843）

Future water security in the major basins of China under the 1.5 degrees C and 2.0 degrees C global warming scenarios

Zhai, Ran; Tao, Fulu; Chen, Yi; 等

Freshwater is an essential resource for human lives, agriculture, industry, and ecology. Future water supply, water withdrawal, and water security under the impacts of climate change and human interventions have been of key concern. Numerous studies have projected future changes in river runoff and surface water resources under climate change. However, the changes in the major water withdrawal components including agricultural irrigation water, industrial, domestic and ecological water withdrawal,

as well as the balance between water supply and withdrawal, under the joint impacts of climate change and socio-economic development have been seldom investigated, especially at the basin and national scales. In this study, changes in surface water resources, agricultural irrigation water, industrial, domestic and ecological water withdrawal, as well as the balances between water supply and withdrawal, under the baseline climate (2006-2015), 1.5 degrees C and 2.0 degrees C warming scenarios (2106-2115) in the 10 major basins across China, were investigated by combining modelling and local census data. The results showed that water withdrawal exceeded water supply in the basins of Liao River, Northwest River, Hai River, Yellow River and Huai River in the baseline period. Under the 1.5 degrees C and 2.0 degrees C warming scenarios, the shortage of water resources would aggravate in the above-mentioned basins and the Songhua River basin. And the surplus of water resources would reduce substantially in the basins of Yangtze River, Southeast River and Pearl River. Overall, the difference between water supply and water withdrawal was 435.88 billion m(3) during the baseline period, and would be 261.84 and 218.39 billion m(3), respectively, under the 1.5 degrees C and 2.0 degrees C warming scenarios. This study provides a comprehensive perspective on future water security in the 10 major basins across China, has important implications for water resources management and climate change adaptation.

（来源：Science of the Total Environment 出版年: 2022, **DOI:**10.1016/j.scitotenv.2022.157928）

From the water sources of the Tibetan Plateau to the ocean: State of nutrients in the Changjiang linked to land use changes and climate variability

Zhang, Jing; Zhang, Guosen; Du, Yanan; 等

Anthropogenic activity is an important driver of changes in the chemistry of nutrients (N, P, and Si) over watersheds at the sub-continental scale (e.g., 10(6) km(2)) and can markedly modify their seaward fluxes to the global ocean. In the present study, we reviewed the current status of nutrient chemistry in Changjiang (Yangtze River) based on data collected through 11 expeditions along a river course spanning 4,500 km and 15-20 major tributaries during 1997-2016 as well as monthly monitoring at the river mouth since 1980. The data were analyzed together with published results in the literature to synthesize the recent developments and current state of nutrients in the Changjiang. Previously published results from the Qinghai-Tibetan Plateau head waters were included to realize the systematics of nutrients for the whole drainage basin. Here, we showed that tributaries of the upper reaches of watersheds collectively determine the regime with high concentration and skewed species ratio of nutrients in the Changjiang mainstream, producing profound effects over a water course of 2,000-2,500 km further downstream and until the river mouth. Moreover, using data across the Three Gorges Reservoir (TGR) during 2003-2016, we evaluated the trapping and/or amplifying effects of the Three Gorges Dam (TGD) on nutrient chemistry. Tide-influenced river delta contributed an additional 20% dissolved inorganic phosphorus and 5-10% dissolved inorganic nitrogen and dissolved silicates to the seaward flux, dramatically affecting the stoichiometry of nutrients at the river mouth. Next, based on compiled data on supply and export, legacy nutrients were evaluated. Both nitrogen and phosphorus are in the accumulation phase over the watersheds, and the legacy nutrient fluxes are much higher than the annual riverine seaward fluxes. Finally, we demonstrated that the seaward fluxes of anthropogenic nutrients from the Changjiang exceed those from other top 10 largest rivers on this planet, which can be attributed to land use changes in the China over the last three to four decades.

（来源：Science China-Earth Sciences 出版年: 2022, **DOI:** 10.1007/s11430-021-9969-0）

Evaluation of water quality at national scale from 2011 to 2021: Advances and challenges

Zhang, Wenqiang; Han, Songjie; Zhang, Dianwei; 等

More environmental policies and larger investments in protecting the aquatic environment in China have been made in the last decade than previously. It is important to assess how this will affect river water quality. Here, changes in water quality in China between 2011 and 2021 are assessed. Water bodies meeting class III or better defined in the Chinese Environmental Quality Standards for Surface Water (GB3838-2002) were labeled WQI, water bodies meeting class V or better but below class III were labeled WQII, and water bodies below class V were labeled WQIII. The percentage of WQI water bodies increased from 66.1 % in 2011 to 81.0 % in 2021, and the percentages of WQII and WQIII water bodies decreased between 2011 and 2021. The percentage of WQI water bodies increased more quickly and the percentage WQIII water bodies decreased more quickly after 2017 than between 2011 and 2016. The percentages of WQI water bodies in the Northwest River Basin (RB), Pearl RB, Southeast RB, Southwest RB, and Yangtze RB were >80 %, and were higher than the percentages of WQI water bodies in the other five RBs. The percentages of WQI and WQII water bodies increased but the percentage of WQIII water bodies decreased in the Hai RB. The percentage of WQI water bodies increased but the percentages of WQII and WQIII water bodies decreased in the Huai RB, Liao RB, Yangtze RB, and Yellow RB. The river monitoring capacity increased and pollution sources, particularly point sources, became more controlled, and this improved river water quality. River management in China has passed the first stage of controlling pollution sources after 10 years of centralized management. The next stage should be focused on strengthening control of non-point sources of pollution and rehabilitating ecological systems to improve river health.

（来源：Science of the Total Environment 出版年: 2022, **DOI:**10.1016/j.scitotenv.2022.157803）

Dynamics and controls of inland water CH_4 emissions across the Conterminous United States: 1860-2019

Yao, Yuanzhi; Tian, Hanqin; Xu, Xiaofeng; 等

Inland waters (rivers, lakes, and reservoirs) have been recognized as hotspots of methane (CH_4) emissions. However, the magnitude and spatiotemporal pattern of CH_4 emissions and their underlying mechanisms remain largely unknown due to a lack of process-based quantification of CH_4 production, consumption, and evasion within the aquatic ecosystem. Here we developed a process-based aquatic CH_4 module within the framework of the Dynamic Land Ecosystem Model (DLEM) to explicitly simulate inland water carbon fluxes and the associated CH_4 processes. We further applied this model to assess the inland-water CH_4 emissions across the conterminous United States (CONUS) as affected by the climate variability, land use, fertilizer nitrogen (N) application, atmospheric N deposition, and rising atmospheric CO_2 concentration during 1860-2019. The inland water CH_4 emissions across the CONUS had doubled from the 1860s (1.65 +/- 0.18 Tg CH_4-C center dot yr) to the 2010s (3.73 +/- 0.36 Tg CH_4-C center dot yr). In the 2000s, inland water accounts for 8% of the regional CH_4 budget that offsets 11-14% of the terrestrial C uptake across the CONUS. Our study showed that the small headwater streams (1st -3rd order) account for 49% of the diffusive CH_4, and reservoirs constitute 50% of the ebullitive CH_4 emissions during the 2010s. Climate change and variability played a dominant role in the increased CH_4 emissions from rivers and lakes. This study implies that effective mitigation strategies to reduce CH_4

emissions should pay much attention to global climate change and headwater stream management.

（来源：Water Research 卷：224 出版年：2022，**DOI:**10.1016/j.watres.2022.119043）

Nitrate concentrations predominantly driven by human, climate, and soil properties in US rivers

Sadayappan, Kayalvizhi; Kerins, Devon; Shen, Chaopeng; 等

Nitrate is one of the most widespread and persistent pollutants in our time. Our understanding of nitrate dynamics has advanced substantially in the past decades, although its predominant drivers across gradients of climate, land use, and geology have remained elusive. Here we collated nitrate data from 2061 rivers along with 32 watershed characteristic indexes and developed machine learning models to reconstruct long-term mean (multi-year average) nitrate concentrations in the contiguous United States (CONUS). The trained models show similarly satisfactory model performance and can predict nitrate concentrations in chemically-ungauged places with about 70% accuracy. Further analysis revealed that five (out of 32) indexes (drivers) can explain about 70% of spatial variations in mean nitrate concentrations. The five influential drivers are nitrogen application rates Nrate and urban area Aurban% (human drivers), mean annual precipitation and temperature (climate drivers), and sand percent Sand% (soil property driver). Nitrate concentrations in undeveloped sites are primarily modulated by climate and soil property; they decrease with increasing mean discharge and Sand%. Nitrate concentrations in agriculture and urban sites increase with Nrate and Aurban% until reaching their apparent maxima around 10,000 kg/km2/yr and around 25%, respectively. Results indicate that nitrate concentrations may remain similar or increase with growing human population. In addition, nitrate concentrations can increase even without human input, as warming escalates water demand and reduces mean discharge in many places. These results allude to a conceptual model that highlights the impacts of distinct drivers: while human drivers predominate nitrogen input to land and rivers, climate drivers and soil properties modulate its transport and transformation, the balance of which determine long-term mean concentrations. Such mechanism-based insights and forecasting capabilities are essential for water management as we expect changing climate and growing agriculture and urbanization.

（来源：Water Research 卷：226 出版年：2022，**DOI:**10.1016/j.watres.2022.119295）

Ecological dynamics and impacts of viruses in Chinese and global estuaries

Cai, Lanlan; Feng, Chao; Xie, Le; 等

Estuaries are important ecosystems providing irreplaceable services for humankind and, in turn, are extensively influenced by human activities and climate changes. Microbial processes, which are largely controlled by viruses, are always responsible for the ecological function and environmental problems in estuaries. However, we know little about the ecology and importance of viruses in estuarine systems. Here, we investigated viral ecological dynamics in estuarine systems on local (four largest estuaries in China in different seasons) and global scales. Viral production varied by almost 20-fold in Chinese estuaries with significant seasonality, being responsible for the removal of 1.41%-21.45% of the bacterioplankton standing stock each day, and contributed directly to the organic carbon pool by releasing an average of 3.57 mu g of cellular carbon per liter per day. By compiling data from 21 estuaries across the world, we found for the first time that viral population size peaked at mid-latitude and

viral production increased towards the equator in estuarine ecosystems. The results indicated the higher viral impact on microbial mortality and dissolved organic matter cycling in tropical estuaries. Our field investigation and global synthesized analysis provide compelling evidence of spatiotemporal variations in estuarine viral dynamics. The global view of viral impacts on estuarine microbial mortality offers important insight for incorporating viruses into ecological models and understanding the environmental implications of the tropicalization of temperate aquatic ecosystems under a scenario of climate warming.

（来源：Water Research 卷: 226 出版年: 2022, **DOI:**10.1016/j.watres.2022.119237）

Impacts of land use land cover change and climate change on river hydro-morphology- a review of research studies in tropical regions

Kayitesi, Naomie M.; Guzha, Alphonce C.; Mariethoz, Gregoire

Tropical regions have experienced the fastest Land Use Land Cover Change (LULCC) in the last decades, coupled with climate change (CC) this has affected the hydrological and geomorphological processes of river systems. With the increased demand for land, the general trend has been the loss of forest land to agriculture and settlements. These changes have altered the water balance components through enhanced or reduced evaporation, peak flow, flooding, and river morphology. The aim of this review paper is to provide a meta-analysis on the effects of spatiotemporal changes in climate and LULC on river hydro-morphology in the tropics. Following a systematic search, 60 case studies were identified, of which the majority (68%) experienced forest loss due to agricultural and urban expansion, resulting in increased streamflow, surface flow, and total water yield and decreased ET and groundwater recharge. 12% of the case studies showed the impacts of LULCC on channel morphology features through sediment transport and riverbank erosion. Results from this study show limited correlation between LULCC and hydrological variables, indicating that there are likely other factors controlling hydrological processes. Catchment heterogeneity including soil and topography play an important role. Based on studies that project these changes into the future, similar trends are expected over the next decades, with differences based on LU and climate scenarios. There are still limited studies on river hydro-morphology responses to LULCC and CC in the tropics despite the major changes taking place there. In light of future changes, more studies are needed to improve our understanding.

（来源：Journal of Hydrology 卷: 615 出版年: 2022, **DOI:** 10.1016/j.jhydrol.2022.128702）

Global-scale characterization of streamflow extremes

Kuntla, Sai Kiran; Saharia, Manabendra; Kirstetter, Pierre

The increasing risk of floods across the globe needs focused attention because of the extensive damage to human lives and economy. A comprehensive understanding of its causative factors is of vital importance. Yet catchment characterization studies are generally limited to case studies or regional domains. A comprehensive global characterization is currently unavailable, which requires collecting and collating a large number of datasets over vast areas. This study embraces large-sample data-driven science as a new paradigm to characterize streamflow extremes by utilizing global datasets of physiographic explanatory variables that could explain various facets of extreme streamflows. Along with the spatial and temporal variations of high streamflow extremes, their correlation with various catchment characteristics such as geomorphology, meteorology, climatology, landcover, lithology, etc. were examined. The multidimensional relationships between the streamflow extremes and catchment

characteristics were modeled using a Random Forest approach and combined with an interpretable machine learning framework to identify the most dominant factors in varying climate classes. Interpretation with SHAP (SHapley Additive exPlanations) reveals that meteorological variables are the most influential variables across the climatic classes. However, the variables and their influences change among different climatic classes. Moreover, different geomorphological variables come into dominance across climatic classes (such as basin relief in warm temperate and drainage texture in arid climates). Overall, the insights from the study could play a crucial role in predicting the unit peak discharge at ungauged stations from the known catchment characteristics. Moreover, these findings can also play a crucial role in formulating risk management strategy.

（来源：Journal of Hydrology 卷: 615 出版年: 2022, **DOI:**10.1016/j.jhydrol.2022.128668）

Diversified evapotranspiration responses to climatic change and vegetation greening in eight global great river basins

Hu, Shi; Mo, Xingguo

Accurately quantifying the impacts of climate change on global hydrological cycles is essential for water resource management. Integrated with the Global Land Surface Satellite (GLASS) leaf area index (LAI), the actual evapotranspiration (ETa) from 1981 to 2012 in eight major river basins (Amazon, Mississippi, Yangtze, Mekong, Lena, Murray-Darling, Nile, and Rhine) was simulated with the VIP (Vegetation Interface Processes) ecohydro-logical dynamic model. The sensitivities and contributions of ETa to climatic change and vegetation greening were explored with the elasticity coefficient method. The results showed that the simulated monthly ETa was consistent with the eddy covariance measurements (determination coefficient (R^2) ranged from 0.5 to 0.85, $p < 0.01$). The simulated annual ETa was also in good agreement with those from the annual water balance ($R^2 = 0.89$, $p < 0.01$) across the eight basins. The relative annual ETa trends in the Amazon and Mississippi basins were negative, approximately-0.09 % year-1, whereas the annual increasing trends in other basins ranged from 0.16 % year-1 to 0.39 % year-1. In the Yangtze and Mekong basins, ETa was more sensitive to vegetation greening, whereas climatic changes were the primary drivers of ETa tendencies in the other six basins in which the dominant driving factors were different, shifted from precipitation in the Mississippi, Murray-Darling and Nile basins to solar radiation in the Amazon basin. Specifically, precipitation and air temperature equivalently contributed to the ETa trend in the Lena Basin. The variations in ETa were strongly linked with El Nin similar to o events in the Amazon basin (energy-limited region) and Murray-Darling basin (water-limited region), reflecting the impacts of global climate extremes.

（来源：Journal of Hydrology 卷: 613 出版年: 2022, **DOI:**10.1016/j.jhydrol.2022.128411）

Occurrence, health risk, and removal efficiency assessment of volatile organic compounds in drinking water treatment plants (DWTPs): An investigation of seven major river basins across China

Zhang, Kunfeng; Chang, Sheng; Wang, Enrui; 等

The presence of volatile organic compounds (VOCs) in drinking water has the potential to harm human health and undermine public confidence. Hence, this is the first study to comprehensively investigate concentrations of 25 VOCs in the 146 drinking water treatment plants (DWTPs) in 24 cities across seven major river basins (including the Yangtze River, Yellow River, Haihe River, Songhua River, Liaohe River,

Pearl River, and Huaihe River), China. The occurrence, human health, and olfactory risks, as well as removal efficiency of VOCs in DWTPs, were evaluated. The findings revealed that 21 VOCs were detected, with concentrations ranging from not detected to 99.10 mu g/L (trichloromethane). The maximum concentrations of trichloroacetaldehyde (54.90 mu g/L) and trichloromethane (99.10 mu g/L) exceeded China's regulated values (GB 5749-2006/2022). The con-centrations of VOCs and water quality parameters showed a strong positive correlation. Human health and ol-factory risks assessment indicated that drinking water exposures do not pose carcinogenic (CR < 10-6) and non -carcinogenic (HI < 1) health risks to consumers, nor do olfactory and taste hazards (OHI < 1). However, it is worth mentioning that due to the relatively high concentrations of some VOCs (trichloroacetaldehyde, acrolein, and trichloromethane), the health risk posed by them are still a major concern that needs to be addressed. Finally, the removal efficiency of VOCs is low in 146 DWTPs (mean of 12.91%-76.79%). Taken together, adding advanced treatment procedures for the purpose of improving the removal efficiency of pollutants of DWTPs in the future is an urgent priority.

（来源：Journal of Cleaner Production 卷:372 出版年: 2022, **DOI:**10.1016/j.jclepro.2022.133762）

Hydroclimatic intensity change in China during the past decades and its future trend based on CMIP5/6

Zheng, Yanxin; Li, Shuanglin; He, Shengping; 等

Changes in the hydrological cycle have far reaching impacts on agricultural productivity, transport availability, energy supply. For example, increasing intensity and declining frequency of rainfall in China have led to a prolonged period of drought as well as more floods, with serious impacts on economics and environment. Different hydrological indices, for instance the accumulated precipitation, the Palmer drought severity index etc., which can reflect the intensity of precipitation or drought, have been proposed to understand the change of hydrological cycle. However, they lead to obvious disagreements in case of China's hydrological cycle because various indices emphasis mainly on either wet or dry feature of the hydrological cycle. The disagreements interfere our ability to manage environmental assets, drought risks, and flood hazards. To reconcile these dis-agreements, this study has utilized a hydroclimatic intensity index (HY-INT) which is proposed innovatively by previous study with advantages in quantifying the intensity of hydrological cycle. HY-INT integrates and am-plifies the signals of precipitation intensity and dry spell length, viewing the response of these two metrics to warming as deeply interconnected. An increase of HY-INT represents the accelerated hydrological cycle and the increased risks of wet and/or dry extremes. Based on the daily gauged precipitation at 540 stations within mainland China, this study has assessed the change of HY-INT in China during 1961-2017. The results show an increasing trend of HY-INT in central-east China, indicating the increasing intensity of hydrological cycle (i.e., more severe droughts and/or rainfall events). While a decreasing trend of HY-INT is observed in northwestern China which implies less wet-dry extremes. Future change of HY-INT is further assessed based on the outputs from climate models in the Coupled Model Inter-comparison Project phase 5 and phase 6 (CMIP5 and CMIP6) under the more realistic medium stabilization emission scenarios. The models are weighted by the performances in reproducing both spatial distribution and inter-annual variability of observed HY-INT. Results of weighted multi-model ensemble suggest an increased hydrological cycle over most part of China, especially in the Yangtze River Basin, indicating more wet-dry extremes. While an exception is seen in northwest China where the HY-INT will decline due to the dominance of the decreased dry spell length over the increased precipitation intensity. This reveals

an alleviated intensity of hydrological cycle and fewer wet-dry extreme events therein, similar to the change in recent decades. The changes of HY-INT are attributed to the different variation patterns in the pre-cipitation probability, which are associated with the change in atmospheric instability and moisture content.

10.1016/j.jhydrol.2022.128437

（来源：Journal of Hydrology 卷: 613 出版年: 2022, **DOI:**10.1016/j.jhydrol.2022.128437）

全球极端降水的热力学驱动机理及生态水文效应

尹家波; 郭生练; 王俊; 等

全球变暖改变了气候系统的热力和动力环境，影响了陆地圈与大气圈的生物地球化学循环过程，对极端降水及陆地碳收支产生显著影响。现有研究发现极端降水一般呈 Hook 气候响应结构，但较少分析其形成机理，也未能量化降水对生态系统生产力的影响，不利于科学评估未来极端气候灾害及潜在生态风险。为了揭示全球极端降水的热力学驱动机理及生态水文效应，文章结合十余套卫星遥感、大气再分析、气候模式、陆面模式、机器学习重构和通量站观测数据集，评估了水-热-碳通量对极端降水的反馈效应，通过大气热力和动力机制的降水效应解释了 Hook 结构形成机理；基于 ISIMIP3b 框架下 5 个全球气候模式集合，预估了未来 Hook 结构迁移路径及其对极端降水的影响，最后结合 CLM4.5 陆面模式探讨了气候变化下降水的碳收支效应。研究发现，极端降水事件往往伴随着剧烈的水-热交换，降水与生态系统生产力及碳收支过程存在非线性响应关系；全球大多数地区极端降水强度上升、历时缩短，三维降水事件更趋集中；大气动力作用是形成 Hook 结构的关键因素，但该结构并不稳定，未来随全球变暖发生动态迁移，可能导致本世纪末极端降水强度增长 10～40%；较充沛的降水有助于生态系统固碳，气候变化下碳收支对降水的响应特征较为稳定。

（来源：中国科学:地球科学，2023,53(01):96-114）

科学视点

青藏高原 132 个湖泊近 40 年湖冰物候数据发布

近日，中国科学院空天信息创新研究院（空天院）、可持续发展大数据国际研究中心（SDG 中心）内陆水环境遥感团队在湖冰物候大范围动态监测与模拟方面取得重要进展。研究团队利用遥感与数值模拟技术，重建了青藏高原 132 个湖泊 1978-2016 年逐年湖冰物候的完整记录。相关数据产品已同步发布在“国家青藏高原科学数据中心”和 Figshare 数据共享平台，成果发表在《自然》子刊 《科学数据》。

湖冰物候，即湖泊的结冰和融冰日期，是反映湖泊能量平衡变化的直观指标，其变化也影响着湖泊水生生态系统及下游的水文特征。由于常规地面观测的局限，青藏高原湖冰物候记录极为缺乏。研究团队集成遥感与数值模拟技术，发展了湖冰物候序列重建的技术框架，重建了高寒地区完整的湖冰物候时间序列。该数据产品覆盖范围广、时间跨度长，为认识青藏高原湖-气作用和长时序水热过程提供重要的技术和数据支撑。

在此基础上，研究团队揭示了青藏高原湖冰物候的时空演化规律及其对气候变化的响应。研究发现，自高原南部向北，完全结冰期（多年平均）从 15 天增加至 215 天，即纬度每升高 1 度，完全结冰期增加约 17.5 天。在 4500~5000 米海拔范围内，海拔每升高 100 米，完全结冰期增加约 18.9 天。全球气候变暖的背景下，近 40 年来，青藏高原湖泊的结冰时间普遍推迟、融冰时间提前、封冻时长缩短等特征表现明显。

此外，研究团队发展的技术框架具有较强的通用性和可移植性，未来可为联合国可持续发展目标“保护和恢复与水有关的生态系统，包括山地、森林、湿地、河流、地下含水层和湖泊”（SDG-6.6）提供监测数据，并揭示物候变化对湖泊水热交换和水生生物群的影响，为湖泊水质和水生生物群的监管提供重要的基础数据和决策依据。

空天院副研究员吴艳红、研究员张兵分别为论文第一作者、通讯作者，澳大利亚联邦科学与工业研究组织（CSIRO）水土研究所研究员郑红星为主要合作者。相关论文信息：https://doi.org/10.1038/s41597-022-01863-9

（来源：科学网， https://news.sciencenet.cn/htmlnews/2022/12/490663.shtm ,根据相关资料编译）

历史降水变率与未来极端降水预估联系

中科院大气物理研究所研究员周天军课题组与英国气象局哈德莱气候中心的合作者指出，中高纬地区极端降水预估模式间不确定性与模式模拟的历史气候降水变率，即降水事件的波动幅度或振荡范围，存在显著相关。相关论文近日发表于《自然-通讯》。

“基于这一结果，我们利用观测的降水变率变化对未来预估结果加以约束，有效降低了特定温升水平下极端降水预估结果的不确定性，降幅可达 20%~40%。”论文通讯作者周天军告诉《中国科学报》。

研究者利用第五次和第六次国际耦合模式比较计划的多气候模式的集合模拟数据，研究了较之工业化前全球平均温升 2°C 和 3°C 等阈值下极端降水频率变化的模式间预估不确定性，发现模式间的差异与各自模拟的历史气候下的降水变率显著相关。具体来说，对于某一个地区而言，气候模式模拟的历史降水变率越小，其预估的未来极端降水频率变化增加得越快。

基于这一联系，研究者建立了针对极端降水预估的“涌现约束”关系。利用该约束关系，结合观测的降水变率，作者对极端降水的预估结果进行了约束。结果表明，该约束方法能有效缩小区域极端降水预估的不确定性范围，还能订正多模式集合预估的最优估计。

在利用气候模式结果并结合观测数据建立涌现约束关系的基础上，作者进一步从统计理论角度探讨了约束关系的合理性。他们对降水进行了统计分布拟合和理想的分布变换，从降水分布模型角度厘清了极端降水频率变化与历史降水变率间存在联系的理论依据，明晰了极端降水预估不确定性的来源，证明了涌现约束关系的可靠性。相关论文信息：https://doi.org/10.1038/s41467-022-34006-0

（来源：中国科学院院网，https://www.cas.cn/cm/202301/t20230130_4873462.shtml,根据相关资料编译）

分布式水文模型追踪青藏高原东北部流域融雪水文过程

山区积雪是全球水循环过程中的关键要素之一，其特殊的物理特性对土壤冻融循环、流域水文过程、植被物候、农田灌溉和水力发电等方面具有重要影响。作为天然的固体水库，积雪是中高纬度地带和高海拔山区水资源的重要组成部分，为全球约 1/6 人口提供日常饮水。然而，气候变暖背景下，全球积雪覆盖面积及其累积和消融动态过程发生显著改变。因此，准确量化积雪变化对水文过程的影响是应对气候变化潜在风险、加强当地水资源管理的必要前提。鉴于现有的水文模型大多不含有水源路径追踪算法，即缺少了从产流至流域出口处的输送路径，仅能根据模型模拟的降雪量、融雪量、降水量和径流量等指标间接估算融雪的径流贡献，无法反映融雪在每个水文环节中的参与程度。此外，变暖背景下积雪变化和水库调节对流域水资源的协同效应研究尚存在空白。

针对上述科学问题，中科院青藏高原所环境变化与多圈层过程团队兰措研究员等通过在基于物理过程的高分辨率分布式水文模型 DHSVM (Distributed Hydrology Soil Vegetation Model) 中，耦合融雪路径追踪算法和水库调节模块，结合野外监测、积雪遥感资料、水库运行数据和气象水文站点数据，从径流、积雪覆盖率、水库变量、土壤含水量等方面检验模型的模拟效果，揭示并预估了青海祁连山南坡北川河流域的积雪动态变化及其水文效应。

研究结果表明：1）1965 年至 2019 年间，北川河流域积雪覆盖率在月尺度和年尺度上均显著下降；相较降水和风速，气温是影响积雪覆盖率变化的最主要因素。2）年尺度上，积雪对土壤水和径流的贡献率也呈显著下降趋势，深层土壤水和下游河道径流的下降速率相对较缓。月尺度上，深层土壤水的融雪贡献率变化幅度较窄，其峰值的出现时间晚于浅层土壤融雪贡献率；河道径流的融雪贡献率在年内呈双峰型分布。3）水库调节虽然对月径流量起到明显的“削峰填谷”作用，但对下游径流的融雪贡献率影响较小(<2%)。4）随着积雪的雪深持续下降，未来流域出口处年径流量将减少 8%左右，特别是春季径流量的下降显著，需要关注。现有的水库调节无法缓解这种下降趋势，亟需制定新的方案应对水资源短缺风险。作者进一步分析发现，以往研究常用的间接指数法忽视了融雪在下渗和蒸散发等过程中的损失，往往高估了径流的融雪贡献率。入射辐射，尤其是入射长波辐射，是积雪累积消融过程的关键驱动，建议未来加强对高海拔地区入射辐射的观测。

（来源：http://www.itpcas.cas.cn/new_kycg/new_kyjz/202212/t20221201_6558071.html,根据相关资料编译）

青藏高原典型气候区中尺度湖泊月变化特征

青藏高原湖泊众多，被称为 “亚洲水塔”，湖泊面积约占全国湖泊总面积的 57.6%，是我国主要的湖泊分布区之一。自 20 世纪 90 年代末以来，受全球变暖影响，青藏高原地区大部分内陆湖泊呈现扩张趋势，南部的湖泊出现一定萎缩。青藏高原的内陆湖泊因其地理位置偏远，较少受到人类活动影响，因此其动态变化可以很好地反映出气候变化对湖泊的影响，是气候变化的重要“指示器”。

基于遥感数据和 2018 年在三个典型湖泊内陆湖架设的自动气象站以及定期开展的水文观测，中国科学院青藏高原研究所地气作用与气候效应团队对三个处于不同气候区的典型内陆湖泊（巴木错、拉昂错和龙木错）进行了湖泊水量年际变化及月变化计算，评估了气候变化对湖泊的影响。研究人员发现，对湖泊变化影响最大的气候因子是降水和气温，由于位于不同的气候区，主导湖泊变化的气候因子也不同。

根据青藏高原地区的大气环流场和局地干湿条件，研究团队将青藏高原划分为季风区、西风区和西风-季风协同作用区，选取其中相邻且地形条件相同的三组湖泊：位于季风区的巴木错-蓬错，位于西风区的龙木错-松木西错和位于西风-季风协同作用区的拉昂错-玛旁雍措。三组湖泊的面积、水位、水量变化趋势均不尽相同，从年水量相对变化（相较于 2012 年湖泊水量）来看，位于季风区的巴木错和蓬错在 2017 年以前相对稳定；位于西风-季风协同作用区的拉昂错和玛旁雍措表现不同，拉昂错逐年萎缩而玛旁雍措在 2020 年前较为稳定，之后水量减少；位于西风区的龙木错和松木西错呈逐年扩张趋势。从 2018 年-2021 年的月相对变化（相对于每一年有湖泊水位观测的第一个月）来看，位于季风区的巴木错水量相对变化逐年增加，具有明显的季节性变化；位于西风季风协同作用区的拉昂错在 2019 年有明

显的水量变化，2020 和 2021 年水量变化相对稳定；位于西风区的龙木错同样是 2019 年有明显的水量变化，可能与 2019 年西风带异常波动有关。

为了进一步理清不同气候因子对湖泊变化的影响，作者对气温、降水、相对湿度和风速与湖泊变化的相关性进行了计算。通过排序发现，不同气候区主导湖泊变化的气候因子不同，且不同时间段的主导因子也不同。在季风区，气温升高是促进湖泊扩张的主要原因；在西风-季风协同作用区，蒸发增加是导致湖泊萎缩的主要原因；在西风区，降水增加是促进湖泊扩张的主要原因。

科研人员定量解析了三个位于不同气候区的湖泊水量变化，评估了不同气候因子对湖泊水量变化的影响，为定量研究不同气候因子对湖泊变化的贡献度提供了重要科学依据。

（来源：http://www.itpcas.cas.cn/new_kycg/new_kyjz/202210/t20221025_6539289.html）根据相关资料编译）

地下水补给显著增加青藏高原西部湖泊水量

中科院青藏高原所环境变化与多圈层过程团队与合作者利用青藏高原西部连续 5 年的湖泊水位和水文气象监测资料发现，地下水补给导致冬季湖面结冰期湖水水位显著上涨，可显著影响青藏高原西部湖泊水位季节和年际变化特征。对认识青藏高原西部地区水循环过程及湖泊变化原因具有重要意义。近日，该成果发表在地学领域著名期刊《地球物理研究通讯》。

青藏高原分布着世界上海拔最高的湖泊群，是我国最主要的湖泊分布区之一。自上世纪 90 年代末以来，受降水增加和冰冻圈加速消融影响，青藏高原内陆区湖泊出现显著扩张，影响了区域生态环境和周边基础设施，引起了国内外学者的广泛关注。

该文章的第一和通讯作者、中科院青藏高原所副研究员类延斌介绍，影响湖泊水量平衡的因素较多，如大气降水、湖面蒸发、冰冻圈消融、地下水补给或渗漏等。由于缺少系统的水文气象观测资料，此前，对高原湖泊水量平衡的研究大多侧重地表水，难以直接监测和量化地下水对湖泊的补给。

青藏高原大多数湖泊在冬季湖面结冰期水位保持稳定或微弱下降。最新监测结果表明，青藏高原西部湖泊在湖面结冰期水位出现显著上涨，如鲁玛江东错、美马错、结则茶卡和龙木错等。在鲁玛江东错和美马错，湖面结冰期的水位上涨幅度可达 0.25-0.35 米，约占全年湖水水位升高值的一半。

综合考虑冬季湖面降雪、入湖径流和湖面升华因素，科研人员发现，冬季湖面结冰期水位上涨的主要原因是地下水补给，其补给量占流域内夏季总降水的 13-25%。对全年湖水水量平衡的计算结果表明，地下水补给占总入湖流量的 59-66%，说明地下水补给不仅对高原西部湖泊水量平衡起到关键作用，还是区域水循环的重要组成部分。

科研人员进一步分析发现，青藏高原西部地下水的形成可能与区域地质构造特征有关。研究区域基岩以石炭纪和二叠纪的灰岩为主，各个流域均分布有地壳断裂产生的活动正断层带，有利于地表水向下渗透形成地下水，并在下游补给湖泊。高海拔地区的冰川、积雪融水通过活动断层破碎带补给地下水，并在低海拔地区汇入湖泊。由于地下水补给稳定且循环周期长，大量地下水补给显著改变高原西部湖泊水位季节变化。该成果相关数据——青藏高原西部湖泊水位监测数据已在国家青藏高原科学数据中心网站共享。

（来源： https://paper.sciencenet.cn//htmlpaper/2022/11/202211221151740077196.shtm,根据相关资料编译）

南极中层水(AAIW)的形成位置和输运路径获揭示

中国科学院南海海洋研究所热带海洋环境国家重点实验室（LTO）研究员杜岩团队利用机器学习的方法识别了三种南极中层水(AAIW)，揭示了三种 AAIW 的形成位置和输运路径。该研究成果由博士研究生夏星月为第一作者发表在期刊 Geophysical Research Letters（《地球物理研究通讯》）上，合作者包括研究员修鹏、助理研究员洪宇。

AAIW 是一种在南大洋亚南极锋面(SAF)周围形成的水团，它源自于南极表层水(AASW)，其形成和输运是南大洋经向翻转环流的分支，对世界大洋的热量、淡水、碳以及营养盐收支具有重要影响。近年来随着观测资料日益增多，我们对 AAIW 的来源及输运路径的理解更加深刻，即便如此，AAIW 的形成在学术界仍存在较大争议。

与以往使用传统属性分类的研究不同，该研究应用了一种无监督的机器学习方法，对 Argo 温度和盐度剖面进行自主分类，并从南大洋体系中识别出三种类型的 AAIW。一是东南太平洋 AAIW，形成于 SAF 以北的德雷克海峡西侧角，会随海流输运到南太平洋的副热带环流系统；二是南太平洋 AAIW，形成于 SAF 周围的南太平洋，会随着 SAF 跨过德雷克海峡，随后和副热带水混合导致其盐度更咸、密度更大；三是绕极 AAIW，为最冷和最淡的 AAIW，分布于 SAF 和极锋(PF)之间的绕极区域，会在德雷克海峡东侧的汇流区域注入海洋内部。分类结果与前人的研究结果相一致，但该研究发现了在不同地区形成不同类型的 AAIW。此外，该研究方法也证明了机器学习技术在处理海洋大数据和识别传统属性分类方法难以区分的 AAIW 类型方面的优势。

（来源：http://www.scsio.cas.cn/news/kydt/202211/t20221108_6546025.html，根据相关资料编译）

中亚干旱区湖泊蓄水量变化研究

湖泊资源是区域乃至全球范围的人类生存、生态系统维护和经济社会可持续发展的关键因素。中亚是典型干旱区，是“丝绸之路经济带”的主要承载区。中亚特定的气候条件，使其生态系统和人类社会对水资源的变化非常敏感且脆弱。在气候变化和人类活动的共同作用下，中亚干旱区湖泊水量发生了显著变化。然而，目前中亚湖泊蓄水量动态变化的系统监测

研究相对缺乏，使得湖泊蓄水量动态变化及其对区域气候变化和人类活动的响应机制尚不清晰。

针对此问题，中国科学院新疆生态与地理研究所荒漠与绿洲生态国家重点实验室陈亚宁研究员团队基于 SRTM DEM 高程数据以及长时序 Landsat 数据，综合采用水体指数、阈值法和随机森林模型等方法构建了面积-高程-蓄水量变化估算经验模型，系统评估了中亚干旱区 9619 个湖泊蓄水量长时序动态变化特征。基于随机森林算法定量评估了气候变化和人类活动与湖泊蓄水量变化之间的关联程度。

结果表明：1990-2020 年，中亚湖泊最大蓄水量和最小蓄水量分别下降了 27.94 Gt 和 144.21 Gt。湖泊蓄水量呈现海拔差异性，3500 米以下的湖泊呈萎缩状态，3500 米以上的湖泊不断扩张。随机森林结果表明，人类活动对湖泊蓄水量变化的重要性高于气候变化，高达 96%的湖泊蓄水量变化可以由人类活动解释。本研究综合评估了中亚地区湖泊蓄水量变化特征，为缓解中亚地区水资源供需矛盾、解决跨境水资源冲突提供了最新的科学数据。

（来源：http://www.egi.cas.cn/xwdt/kydt_163364/202210/t20221031_6542078.html 根据相关资料编译）

塔里木河流域输沙量变化及其驱动因子

河流输沙量是客观反映流域水土流失强度变化的重要指标，是全球水土流失研究的重要内容。与径流相比，河流输沙对气候和地表过程的变化更为敏感。在全球气候变化背景下，由于自然过程和人类活动的共同作用，全球许多河流的径流和输沙都发生了很大变化。干旱区内河流域输沙量的变化特征和驱动因子与湿润区存在明显差异。而现有研究，较多关注气候变化背景下湿润地区和青藏高原河流输沙量变化，对于中国最大的内陆河——塔里木河流域的输沙研究较少，该流域以冰川积雪融水补给为主，对气候变化十分敏感，输沙量变化机制复杂，驱动因子尚不明确。

针对以上问题，中国科学院新疆生态与地理研究所荒漠与绿洲生态国家重点实验室研究员陈亚宁团队采用 Mann-Kendall 趋势检验、贡献率和敏感性分析等方法定量解读了塔里木河流域输沙量动态变化及其与各驱动因子间的关系。

结果表明，发源于天山山脉的开都河和阿克苏河年输沙量分别以 3.8503×10^7 kg /年 ($p < 0.01$)和 47.198×10^7 kg /年的速率下降（2001 年至 2019 年），输沙量对秋季和冬季积雪面积占比的变化更为敏感。发源于喀喇昆仑山的叶尔羌河和玉龙喀什河的年输沙量分别以 21.807×10^7 kg /年和 27.774×10^7kg /年的速率增长（2001 年至 2019 年），输沙量对年径流量更为敏感。从贡献率上看，除开都河外，其余三条河流年径流量对输沙量变化的贡献最大。研究结果对于了解气候变化对干旱区大型内陆河流域输沙量的影响机制至关重要。

（来源：http://www.egi.cas.cn/xwdt/kydt_163364/202211/t20221128_6556758.html，根据相关资料编译）

湖泊中被忽略的无机还原态磷（IRP）的生态效应

全面阐明湖泊磷循环过程并揭示其对生态系统影响一直是环境科学领域研究热点。由于传统认知和分析方法不足，绝大多数研究均以正五价的磷酸盐(P+V)为基础，忽略了磷化氢(P-III)、次亚磷酸盐(P+I)和亚磷酸盐(P+III)等无机还原态磷(简写“IRP”)，致使当前对湖泊磷生物地球化学循环过程认识存在明显的“缺失”。IRP 在湖泊中广泛分布且沉积物被证实为 IRP 产生和释放的热点区域。在人类活动和全球变化双重干扰下，许多湖泊正面临强烈的湖泊环境变异，形成的强厌氧还原环境将加剧 IRP 的形成和释放。水体中蓄积的 IRP 可能对湖泊生态环境系统产生潜在的危害，然而该研究尚未开展。

在此背景下，中国科学院南京地理与湖泊研究所韩超等研究人员系统开展 P+III/P+V 暴露对优势水生植物苦草和藻类的适生性影响研究。结果发现：(1) 试验藻生长均被抑制，P+III 无法作为有效磷源被藻直接吸收利用；且较高浓度 P+III (0.01–0.7 mg/L) 会对藻类产生明显的毒性效应，而铜绿微囊藻和小环藻细胞破坏最为显著。这表明富营养化水体蓄积的 IRP 会加速藻类的死亡分解，在抑制蓝藻暴发方面具有积极作用。(2) 通过苦草的根系和叶片 P+III 暴露模拟实验证实，P+III 对苦草根系、叶片、生物量等生长指标同样具有显著的抑制效应，较高 P+III 浓度诱导植物细胞产生显著的氧化应激效应，P+III 对于叶片造成的损伤症状显著高于根系损伤。由此表明水中增加的 P+III 无法被苦草根系或叶片吸收利用，而且会对苦草生长和代谢产生毒害效应，在今后水生态风险评估中需要特别注意。

（来源：http://www.niglas.ac.cn/xwdt_1_1/yjjz/202212/t20221219_6585637.html，根据相关资料编译）

太湖溶解性有机物来源与生物活性高频观测

湖泊是特大型和大中型城市的最重要集中式供应水源之一，湖泊中溶解性有机物（DOM）的来源组成会直接影响饮用水处理消毒剂的使用剂量、消毒副产物的产生及重金属等有毒有害物质的毒性和生物有效性，因而决定了饮用水处理工艺与流程。全球湖库等内陆水体每年承接、输移的碳通量高达 5.1 PgC yr^{-1}，而以溶解性有机碳为主要成分的 DOM 又是湖库水体中天然有机质最重要的赋存形态及活跃成分。因此，精确掌握 DOM 的来源与生物活性，对饮用水安全的保障至关重要。

降雨事件（尤其是暴雨事件）将陆源 DOM 及营养盐输出到溪流、河流和进而裹挟输入至下游湖泊，从而深刻改变了湖库 DOM 来源组成与活性。但当前常规湖库水质监测通常为逐周、逐月甚至逐季度开展周期性采样观测，该类方法往往无法捕捉到偶发暴雨事件中 DOM 组成的生物地球化学变化。目前也鲜有研究利用高频监测来探讨暴雨如何改变汇入河流中 DOM 汇入通量、组成和生物活性的报道。

鉴于此，中国科学院南京地理与湖泊研究所张运林研究员研究小组周永强等人在太湖最重要的两条入湖支流大浦河和殷村港进行了为期三年的逐日观测。使用 DOM 光谱和傅里叶变换离子回旋共振质谱（FT-ICR MS）等技术，分析了暴雨前后 DOM 的分子组成变化特征，并通过室内好氧环境 28 天微生物培养实验完成 DOM 生物可利用性的测定，进一步揭示了暴雨对汇入河流中 DOM 的组成和生物活性的影响。

初步研究结果表明，暴雨事件提高了太湖入湖河流殷村港与大浦河 DOM 的芳香性水平和生物活性。大浦河汇入太湖的溶解性有机碳（DOC）和生物活性（BDOC）通量分别为 $1.15 \pm 0.18 \times 104$ t C yr^{-1} 和 $0.23 \pm 0.06 \times 104$ t C yr^{-1}，而殷村港汇入太湖的 DOC 和 BDOC 通量分别为 $2.92 \pm 0.42 \times 103$ t C yr^{-1} 和 $0.53 \pm 0.07 \times 103$ t C yr^{-1}。暴雨发生期间，大浦河入湖 DOC 通量变幅为 34.0 至 62.3 t d^{-1}，BDOC 通量为 10.3 至 25.5 t d^{-1}，相较之下殷村港 DOC 汇入通量为 11.3 至 18.2 t d^{-1}，BDOC 通量为 3.1 至 4.6 t d^{-1}。FT-ICR MS 结果显示，暴雨事件发生期间多环和缩合芳香烃和多酚类化合物的相对丰度增加，高度不饱和和酚类及脂肪族化合物的相对丰度减少。通过对近 60 年来气象数据统计结果表明，太湖流域大雨及暴雨事件出现频次呈上升趋势，大雨降水强度亦存在上升趋势。

（来源：http://www.niglas.ac.cn/xwdt_1_1/yjjz/202212/t20221212_6578888.html，根据相关资料编译）

湖泊：重要性和生态服务价值长期被低估

湖泊，大地上的璀璨“明珠”，具有极其重要的生态价值但也面临严峻的生态环境问题。中国科学院南京地理与湖泊研究所张运林研究员等从饮用水安全供给、湖泊调蓄、生物多样性等方面系统阐述和量化了湖泊重要性及生态服务功能；明晰了我国湖泊面临的富营养化与藻类水华、水生植被退化、湖泊萎缩咸化与扩张等主要生态环境问题，提出了湖泊保护与治理的对策。

湖泊（含水库）是陆地表层系统最基本的地理单元，也是地表水资源的重要载体，对全球环境变化及流域人类活动响应敏感，是全球环境变化与区域气候的指示器和调节器，同时也是“山水林田湖草沙”生命共同体的重要组成部分。根据 2020 年最新遥感监测结果显示，我国 1km^2 以上天然湖泊有 2670 个，累计面积 80662.4km^2，1km^2 以上人工水库共 5156 座，累计面积 39697.1km^2，合计总面积 120359.5km^2。

尽管湖泊面积及其在陆地中占比相对有限，但其在保障生态文明建设和促进流域经济社会发展等方面发挥着不可替代的作用。长期以来，湖泊的重要性和生态服务价值被严重低估，也缺乏必要的量化表征。鉴于此，中国科学院南京地理与湖泊研究所张运林研究员等系统阐述和量化了湖泊重要性及生态服务功能。主要表现在以下 7 个方面：

（1）湖泊是保障饮用水安全的重要基石，服务全国近 50%人口集中式饮用水，在北京、上海、深圳等 10 个重点城市湖泊型集中式水源地服务人口比例更是高达 70%以上。

（2）湖泊具有重要的调蓄功能，在防洪抗旱方面发挥关键作用，面积大于 1km^2 的天然湖泊水量调节总量接近 1500 亿 m^3，长江流域 47 座控制性水库总调节库容超过 1000 亿 m^3。

（3）湖泊型流域在国民经济发展和粮食安全保障中发挥举足轻重作用。以长江流域为例，10km^2 以上湖泊有 145 个，其对应的流域面积占长江流域面积的 33.6%，但其人口和 GDP 分别占长江流域的 45.0%和 47.4%，太湖流域国土面积仅占全国的 0.4%，却贡献了全国近 10%的 GDP。

（4）湖泊是生物多样性最丰富的生态系统之一，孕育出极为丰富的生物资源。

（5）湖泊渔业在我国渔业生产中占据重要地位，2019 年湖泊水产养殖面积占全国水产养殖面积的 30.8%，1980 年其占比更是高达 59.9%。

（6）湖泊具有重要的旅游价值，成为众多城市的亮丽名片，2021 年文化和旅游部共确定了 306 个国家 5A 级旅游风景区，其中涉湖的 5A 级旅游风景区有 57 个，占 18.6%。

（7）湖泊是北方生态安全屏障重要组成部分和关键节点，青海湖、呼伦湖、博斯腾湖、艾比湖等在区域生态安全保障中具有举足轻重的作用。

此外，湖泊在蓄能发电、农业灌溉、内河航运、固碳降污及区域气候调节等方面发挥重要作用。

我国湖泊数量众多、类型齐全、分布广泛，生态环境问题呈现明显的区域分异，面临的主要生态环境问题有：

（1）湖泊富营养化和蓝藻水华没有得到根本缓解，湖泊水源地水质安全威胁依然存在；

（2）湖泊水生植被退化严重，净化能力减弱，生物多样性下降，生态系统完整性和稳定性受损；

（3）气候变化与人类活动叠加造成湖泊洪旱灾害和萎缩咸化并存；

（4）暖湿化气候背景下青藏高原湖泊快速扩张，冰湖溃决风险显著增加。

针对不同区域湖泊生态环境问题，从湖泊流域系统治理、重大生态修复工程、湖泊监测管理与立法保护等方面提出湖泊保护与治理的策略和对策，推动湖泊环境质量改善与美丽湖泊建设。随着国家湖泊流域系统治理力度的不断加大，科技创新能力持续增强，系列治理工程有序实施，流域产业结构优化升级，河湖管护能力稳步提升，必将重现水清草盛、鱼翔浅底的美丽湖泊画卷！

（来源：http://www.niglas.ac.cn/xwdt_1_1/yjjz/202212/t20221205_6566332.html，根据相关资料编译）

DNA 显示潜在的有毒蓝藻随着气候变化而增加

全球蓝藻水华的扩张已经严重威胁到水质、食物网和人类健康。当有毒蓝藻类群存在时，水华的不利影响更加严重。通过监测、卫星遥感和建模，蓝藻水华的发生规模和物候学已被广泛研究。研究普遍认为，人类引起的营养物质输入和气候变化是导致全球范围内蓝藻水华扩张的主要因素。然而，由于缺乏可靠的长期监测数据，对潜在的有毒蓝藻长期变化趋势及其驱动因素尚缺乏认识。

为了弥补长序列监测数据不足的问题，古湖沼学家利用保存在湖泊沉积物记录中的各种物理、化学和生物代用指标来重建长期环境压力对水生生态系统的影响。由于蓝藻通常不能作为微化石很好地保存下来，传统的显微镜技术难以揭示过去蓝藻群落组成的变化历史。近年来，沉积 DNA（sedaDNA）技术为重建蓝藻群落演替的长期动态提供了新途径。

研究基于在太湖蓝藻水华最严重的区域获取的沉积物岩芯，采用 sedaDNA 方法追踪了过去约 100 年内太湖蓝藻群落对气候环境变化的响应。首先，利用高通量测序技术重建了高分辨率的蓝藻群落结构的变化。其次，使用临界点分析方法确定蓝藻群落转变的时间和临界点，并分析相应阶段的群落特征。最后，通过与气候变化数据以及湖水营养监测数据对比，评估蓝藻群落变化与气候变化和营养条件的关系。

研究发现，太湖蓝藻群落的突变发生在 1991 年和 2009 年前后。蓝藻群落的网络分析揭示，在每个突变点之后，蓝藻群落逐渐变得更加复杂和不稳定。这一转变可能与 1980 年代以来潜在的有毒蓝藻类群（Microcystis spp.）丰度逐步增加有关。相关分析显示，温度和风速可能是蓝藻群落变化的主要驱动因素。近几十年来，气候变暖和风速减弱促进了太湖潜在有毒蓝藻类群的生长，这可能抵消了污染控制措施的积极效应。在未来气候变暖的背景下，富营养化湖泊中的有毒蓝藻水华可能更加严重，严重威胁水生生态系统和饮用水安全。 相关成果发表在国际权威期刊 Water Research 上。

（来源：http://www.niglas.ac.cn/xwdt_1_1/yjjz/202211/t20221130_6557504.html，根据相关资料编译）

丘陵区沟塘系统脱氮过程与机制

丘陵地区小流域坡地耕作与沟塘蓄水利用构成了具有明显地域特点的水土关系与“源-汇”景观，是平衡农业发展与水源保护的重要自然方式。然而，近些年来在农业激励政策和特色农产品快速需求的驱动下，坡地农业开发面积和强度均显著增加，导致坡地大量氮流失并突破沟塘阻控的第一道防线，严重污染下游水体。因此，如何将流失的氮高效地滞留在沟塘系统并促进其反硝化降减是保障丘陵区清水产流的重要科学问题。

已有研究多聚焦在平原区沟塘的消纳过程和机制，然而对于水文联系紧密和物质交换频繁的丘陵区沟塘，其氮素输送、滞留及其反硝化发生的环境条件变化复杂，氮“汇”机制仍亟待揭示。在此背景下，精准辨识丘陵区沟塘反硝化的热/冷点时区并施以针对性调控是保障清水产流的重要需求，同时也是面源污染控制工程（如氮输移过程拦截、反硝化沟工程选址及沟塘滞留调蓄等）高效实施的关键技术瓶颈。

鉴于此，中国科学院南京地理与湖泊研究所李恒鹏研究员团队张汪寿等人围绕丘陵区沟塘系统脱氮过程与机制开展研究，取得了如下研究成果：

（1）丘陵区不同沟塘脱氮潜力差异大，并与其集水区土地利用类型相关：研究发现丘陵区沟塘是重要的氮“汇”，但受到集水区不同来水水质的影响，其脱氮潜力存在较大差异。茶园集中开发区氮流失强度大，其沟塘的脱氮速率也最高，达到 6.48 mmol N_2 $m^{-2}d^{-1}$，是村塘、林塘及其他类型塘的 2-6 倍；茶园塘和村塘溶解氧含量低、碳源供给相对充足，其脱氮效率最高，接近 15%，是其他类型塘的 1-2 倍。这些结果从理论的角度证实了采用沟塘消纳农业区及村落污染物的有效性，同时也揭示了一旦集水区土地利用发生变化，其沟塘脱氮潜力也会相应的改变。研究还进一步阐明了不同类型沟塘脱氮能力提升的关键限制性因素，为环境因子调控与沟塘截留净化能力提升提供了重要的科学支撑。

（2）研究揭示了丘陵区沟塘发生脱氮作用的时空热点及主控因子：沟塘脱氮效果总体显著，日均降氮幅度可高达 15%-20%，但脱氮过程呈现鲜明的昼夜波动规律，夜间是发生脱氮的热点时段，平均比白天高出 20%以上。脱氮速率最高的时间段为早晨 06:00，是下午 14:00 低值的近 10 倍。溶解氧、pH 等物理指标的昼夜波动是决定塘坝脱氮速率日尺度变异的主要控制因子；塘坝脱氮过程各月差异大，脱氮潜力最高的月份主要发生在水热同期的 6-9 月份。坡地养分流失、温度及塘体的生态条件是决定脱氮速率逐月变化的主要因子；此外，研究还发现沟塘水陆交错带是发生脱氮作用的热点区域。研究建议从扩大脱氮热点区域、延长热点期水力停留时间两个方面来进一步提升沟塘的拦截净化能力。

（来源：http://www.niglas.ac.cn/xwdt_1_1/yjjz/202211/t20221121_6551215.html，根据相关资料编译）

全球湖泊水色观测：MODIS 陆地反射率的潜力和局限

近海岸与内陆湖泊与人类密切相关，其环境正经历史无前例的改变。监测其水环境时空格局，将有助于理解水体的变化趋势，优化水环境管理方式。如今，传统野外调查和实验室测量的方式在观测区域或全球水体变化方面存在时空尺度有限等问题，而卫星遥感则凭借着大尺度覆盖、高频率重访、免费等优势，优势愈发凸显。目前，水色遥感已成为水体监测的重要手段之一。然而，传统水体大气校正方法在浑水时常失效，遥感反射率的缺失与较高的不确定性造成传统水色遥感定量反演算法难以应用，一定程度上限制了大尺度水色遥感的进程。

不同于开阔大洋，近海岸和内陆水体（湖库、河流）相对较为浑浊，因此，MODIS 等数据的陆地反射率产品近年来被用于监测湖泊蓝藻水华、透明度和浊度，但却鲜用于观测叶绿素 a、藻蓝素、CDOM 等研究。至今，有关 MODIS 陆地反射率的两个基础问题尚不明确：一是 MODIS 等陆地反射率产品在全球近岸和内陆水体的精度究竟如何？是否可靠？二是 MODIS 陆地反射率可被用于观测哪些水色参数？

面向 MODIS 陆地反射率观测全球水体的性能基准问题，中国科学院南京地理与湖泊研究所曹志刚博士基于全球 4143 条实测光谱、2320 个叶绿素 a、1467 个悬浮物数据，全面解析了 MODIS 陆地反射率产品在全球水体的潜力和局限性。

研究主要结论概括如下：

（1）MODIS 陆地反射率产品(R_land)在全球水体显著高于实测遥感反射率（Rrs），在红光和绿光波段具备一定的精度（红光：MAPE=22%，绿光 MAPE=37.6%），但在 469nm 和 859nm 精度较差。全球的评价结果与之前在太湖和 Chesapeake 湾的评价结果相似（Feng et al. 2018. WRR）。对比于传统短波红外水色大气校正方法（Rrs_SWIR），R_land 亦出现高估，并且二者在空间上出现不一致，R_land 在浑-清水界限时存在“突变”现象。

（2）R_land 图像不仅存在“突变”，其在所有波段亦存在大量负值。以 555 nm 为例，2003-2020 年的 R_land 负值在全球广泛分布，澳大利亚、印度以及非洲西部沿海区域甚至超过了 5%。概括而言，R_land 在浑水区域出现的负值较低；但是，近红外波段在富营养化严重及藻华区域的负值显著，例如 859 nm 在太湖超过了 7%，在 Chesapeake 湾超过 20%。负值的出现主要与陆地大气校正中气溶胶信号过校正以及气溶胶信号估算模式有关。

（3）R_land 与机器学习相结合成功估算了全球水体悬浮物浓度，但无法用于准确获取全球水体叶绿素 a 浓度。随机森林、支持向量机和 XGBoost 等方法均比传统经验和半分析算法具备更好的精度，在全球水体悬浮物浓度的估算误差小于 25%，可用于估算全球近岸和内陆湖泊的悬浮物浓度分布。但是，R_land 无法获取准确的叶绿素 a 浓度，机器学习模型误差亦超过 50%。

（4）对于蓝藻水华、水生植被等图像解译而言，R_land 主要是影响空间突变及负值等。对于水色因子的定量反演而言，R_land 在红光和绿光具备一定精度，因此可用于获取悬浮物相关的参数，包括了透明度、下行漫射衰减系数等。倘若这些参数与叶绿素 a 相关（如清水），则性能会有所下降。主要由于 R_land 波段所限以及近红外和蓝光的高不确定性，R_land 目前无法获取大尺度的水体色素相关参数，如叶绿素、藻蓝素、DOC、POC 等。因此，R_land 虽能快速获取和处理，但并不是水色遥感的最优选择，具体应用时需谨慎。

（来源：http://www.niglas.ac.cn/xwdt_1_1/yjjz/202211/t20221107_6545402.html，根据相关资料编译）

太湖底栖动物扰动及其密度变化对沉积物磷释放和水体磷水平的影响

湖泊富营养化是严重的全球性环境问题，尽管投入了大量资源用于控制外源营养物质的输入，但很多大型湖泊蓝藻水华没有得到有效控制。大量研究表明，沉积物磷的释放是导致水体磷水平较高和蓝藻水华频发的重要原因，气候变化导致的水温升高以及风速降低等被认为是引发沉积物磷释放的主要原因。底栖动物是湖泊生态系统的重要类群，它们的扰动行为可直接影响沉积物中磷的生物有效性。然而，大型富营养化湖泊底栖动物的扰动及其密度变化是否影响沉积物磷的释放和水体中磷的水平尚不清楚。

太湖属大型浅水富营养湖泊，蓝藻水华频繁暴发。研究基于 2007-2020 年太湖底栖动物的优势种及其密度变化，选择太湖底栖动物中的优势种—钩虾亚目的太湖大螯蜚（下文俗称钩虾）作为研究对象，采用荧光示踪技术、平面光极（PO）技术、薄膜扩散平衡（HR-Peeper）以及薄膜扩散梯度（DGT）技术研究了钩虾扰动对水流量、沉积物混合、沉积物中氧气动态和沉积物磷释放的影响，探究了太湖底栖动物密度变化对沉积物磷释放以及水体磷水平的影响。

研究发现，2007-2020 年太湖底栖动物的总密度下降了 93%，其中优势种霍甫水丝蚓、摇蚊幼虫以及钩虾的密度下降明显，而其他优势种河蚬和铜锈环棱螺的密度呈现波动变化。通过平面光极获取的高时空分辨率氧气二维变化可知，太湖钩虾通过生物灌溉增加了沉积物中氧气的可利用性和渗透深度，同时钩虾的间歇性通风活动导致洞穴及其周围沉积物中产生高度的氧化还原震荡。其他优势种，如霍甫水丝蚓和摇蚊幼虫扰动，也可以向沉积物中输送氧气，然而河蚬和铜锈环棱螺扰动会消耗表层沉积物中的氧气。

沉积物中氧气的可利用性将改变沉积物中铁的氧化还原状态，进而影响磷的生物有效性。研究发现，钩虾洞穴中的氧气扩散到周围的沉积物中并形成氧化层；还原性铁从厌氧沉积物中扩散至洞穴附近并被氧化；沉积物中释放的可溶性磷被氧化铁吸附并以铁结合态磷的形式滞留在氧化层中，从而减少沉积物中磷的释放。已有的研究结果表明，霍甫水丝蚓和摇蚊幼虫扰动也可通过增加沉积物中氧气的可利用性减少磷的释放(Chen et al. 2015, 2016a)，而河蚬和铜锈环棱螺则会通过消耗表层沉积物中的氧气增加磷的释放(Chen et al. 2016b; Yang et al.2020)。因此，推测钩虾、霍甫水丝蚓和摇蚊幼虫密度降低是加剧太湖沉积物磷释放和维持太湖水体磷水平的重要因素之一。未来进一步研究和量化底栖动物密度和优势种的变化对沉积物磷释放的影响，可以更好地认识内源磷循环规律，对于控制湖泊富营养化具有重要意义。

（来源：http://www.niglas.ac.cn/xwdt_1_1/yjjz/202210/t20221031_6541869.html，根据相关资料编译）

暴雨影响水库河口区有机碳组成与碳排放

水库作为重要的水生态系统，其碳源汇动态对全球碳循环与碳收支有着重要影响。暴雨过程中微生物高代谢率以及来自上游有机物的持续输入和降解可能是水库碳排放的一个重要来源。暴雨会导致水温、溶解氧和水化学特征，尤其是溶解性有机物（DOM）来源组成发生巨大变化。这些参数通常在几个小时到几天内迅速波动，并显著影响二氧化碳和甲烷的产生和排放。然而，对水库水体理化参数和 DOM 来源组成的分析往往依赖于逐周、逐月、乃至逐季度的野外观测。

常规周期性监测手段往往无法捕捉到暴雨等偶发性事件发生发展规律，鉴于此，中国科学院南京地理与湖泊研究所张运林研究小组周永强等人在千岛湖上游新安江流域对暴雨事件前后水体理化性质和 DOM 来源组成的动态变化以及对碳排放的作用机制展开研究。利用 DOM 光谱和傅里叶变换离子回旋超高分辨率共振质谱（FT-ICR MS）等手段，揭示了暴雨事件前后 DOM 的来源组成，利用 Picarrro 碳同位素分析仪分析了暴雨前后甲烷和二氧化碳的稳定同位素组成，弥补了暴雨事件对水化学和 DOM 来源组成动态的影响以及对二氧化碳和甲烷的排放通量影响研究的空白。

研究结果表明，暴雨事件会在短时间内显著提高流域内的陆源有机碳和二氧化碳和甲烷排放通量。暴雨会导致流域内大量高度不稳定有机质在水体内富集，为生态系统异养呼吸提供了绝好的基质，同时 DOM 的降解和颗粒状有机质的存在，在水-沉积物界面创造了适合厌氧微生物产甲烷的厌氧环境，从而增强甲烷排放。此外，暴雨过后的低压环境，以及水库中氮、磷水平的显著升高，也会影响二氧化碳和甲烷排放通量的升高。上述研究结果表明，由于气候变化导致暴雨的发生频率和降雨强度的增加，可能会增加不稳定有机质对水库的输入，未来应当加强在极端暴雨事件期间的高频监测，以期为水库碳排放管理方案的制定提供参考依据。

（来源：http://www.niglas.ac.cn/xwdt_1_1/yjjz/202210/t20221023_6538115.html，根据相关资料编译）

东非湖泊沉积物氮转化过程

东非湖泊类型多样，具有出不同的形态、地质成因以及盐度和流域特征，还包含了世界上初级生产力和盐碱度最高的湖泊群。高温、高光强和充足的二氧化碳供应支持了东非湖泊浮游生物快速的碳代谢，不过，东非湖泊的初级生产活动可能受到氮限制，因为与人口密集的北半球温带和亚热带湖泊相比，这些湖泊得到的氮营养盐输入通常较少。在无机氮供应不足的湖泊中，底部沉积物有机质的矿化可能对湖泊氮循环和损失具有重要的驱动作用。目前，东非多生态类型湖泊氮素内循环转化及来源途径方面较少有研究涉及。为了揭示东非湖泊沉积物氮转化特征及其驱动因子，中科院南京地理与湖泊研究所张路团队于 2020 年 2 月至 3

月，联合坦桑尼亚渔业研究所科研人员，完成了对坦桑尼亚境内湖泊的野外样品采集，并开展了相关研究工作。

研究采用稳定 ^{15}N 同位素示踪技术，探究了东非 16 个湖/库沉积物氮转化的 5 个主要过程：有机氮矿化、氨氮固定、硝酸盐异化还原为氨（DNRA）、反硝化和厌氧氨氧化。研究发现沉积物氮转化潜在速率与沉积物有机质含量和组成密切相关。内源类蛋白有机物的增加促进了沉积物氮矿化、硝酸盐异化还原为氨和反硝化速率，而难降解陆源腐殖质类有机质的大量输入降低了氮转化速率，再生氮的供给不足，可能加剧氮限制条件。沉积物氮转化与有机质性质之间的密切联系可能共同反映了微生物代谢活动对碳氮可利用性变化的响应。此外，大部分湖泊硝酸盐还原以反硝化为主，其占比为 26%-85%（平均 65%），潜在 DNRA 速率占硝酸盐异化还原速率的 10%-74%（平均 25%）。DNRA 占硝酸盐还原比例受沉积物有机碳氮比值、水体盐度和硫酸盐浓度的显著影响。本研究的结果表明综合沉积物有机质性质分析可以改善对东非湖泊沉积物氮供应和损失的预测。 相关研究成果以 Sediment organic matter properties facilitate understanding nitrogen transformation potentials in East African lakes 为题，发表在国际英文期刊 Science of The Total Environment 上。

（来源：http://www.niglas.ac.cn/xwdt_1_1/yjjz/202210/t20221019_6535675.html，根据相关资料编译）

我国湖库河流水体二氧化碳排放通量机驱动机制

在气候变暖和人类活动双重因素叠加背景下，湖库河流碳循环尤其是碳排放特征及驱动机制受到国内外学者的广泛关注。近年来，国内针对我国湖库河流碳排放的研究集中在单个湖库或某段河流，人类活动对湖库河流水体碳排放的影响也受到持续关注。然而，值得指出的是全国尺度的湖库河流水体二氧化碳排放通量特征及驱动机制鲜见报道。

鉴于此，中国科学院南京地理与湖泊研究所张运林研究员团队周永强等人通过将野外数据采集与文献数据汇编相结合，对近 20 年来我国湖库河流水体二氧化碳通量开展研究，总计获取 1405 个样点（水库 122 个、湖泊 625 个及河流 658 个）二氧化碳通量数据，系统分析了我国湖库河流水体二氧化碳排放特征及驱动因素。

依托中国科学院资源环境科学与数据中心、国家地球科学数据中心等平台获取 30m 及 1km 分辨率土地利用类型、总初级生产力（GPP）、净初级生产力（NPP）等系列数据产品。对各样点进行流域剖分、裁剪得到各样点对应流域城市与农田用地比重、GDP、人口密度、NPP、表层土壤有机碳、表层土壤 pH、降水量等数据，在此基础上揭示了我国湖库河流二氧化碳排放通量的驱动机制。

研究结果表明，河流水体每年二氧化碳排放通量比湖库水体排放通量高出一个数量级，我国湖库河流水体以二氧化碳形式排放的碳通量每年达 61.9±55.3 百万吨。河流、湖泊的二

氧化碳排放通量随城市用地比重增加而显著上升，湖泊、水库二氧化碳排放通量随农业用地比重上升而显著增大，河流、湖泊和水库二氧化碳排放通量均与流域平均人口密度、GDP 呈显著正相关。河流、湖泊和水库水体二氧化碳通量与流域净初级生产力水平 NPP、表层土壤有机碳、表层土壤 pH、降水量并无显著相关性。以往研究证实，高强度人类活动将致使大量工农业及生活废水排放，造成湖库河流水体富营养化，大量生物活性强的还原性有机碳的输入会极大程度提高湖库河流水体生产力，进而加速水体有机碳微生物降解，消耗水体中溶氧，从而促使二氧化碳排放。上述研究结果表明，在人口聚集区，人类活动强度对湖库河流水体二氧化碳排放的影响已远超出流域净初级生产力的影响。随着未来城市化发展，发展中国家更多的土地将由森林、草原等未干扰区被开发为城镇用地或农业用地，由此带来的对湖库河流水体碳排放的影响尤应引起重视。

（来源：http://www.niglas.ac.cn/xwdt_1_1/yjjz/202210/t20221013_6523798.html，根据相关资料编译）

鄱阳湖丰水期与枯水期水体活性氧物种（ROS）产生特征

活性氧物种（reactive oxygen species, ROS）是一类直接或间接的由分子氧转化而来，具有未配对电子的物质，具有极强的化学反应活性。ROS 在天然水体中无处不在，并且在水体的光化学、氧化还原反应中发挥着重要作用，主要包括：影响水环境中有机污染物及难分解有机质的降解及转化；参与水环境中微量元素的化学反应；改变微生物的群落结构和功能等。

水环境中的 ROS 主要来源于水体中可溶性有机物（DOM）的光化学过程。DOM 是一种结构多变的复杂分子，已有研究发现，水环境变化如营养物含量或水位变化，会改变 DOM 的分子特征进而影响 DOM 的光化学特性。对于鄱阳湖这一典型干湿交替的内陆湖泊来说，丰水期与枯水期交替引起的水位变化促使 DOM 结构特征产生显著改变。但目前对于丰水期和枯水期交替变化下 DOM 组成变化引起的 ROS 含量变化的过程及机制并不清楚，以及此过程下产生的 ROS 对污染物的影响尚不明确。

鉴于此，中国科学院南京地理与湖泊研究所江和龙研究员研究小组宋娜等人通过对鄱阳湖连续三年的追踪，明确鄱阳湖丰水期和枯水期水体中三种主要的 ROS（3CDOM*、1O2 和 OH）的产生特征，结合 DOM 的光化学特征及组分分析，探究了引起 ROS 变化的主要 DOM 组分，构建了 ROS 多元预测模型，最后确定了 ROS 稳态浓度对水体中污染物分解的影响。

研究结果表明，三种 ROS 在丰水期的产率均显著高于枯水期，丰水期的 DOM 以外源为主，具有较高的分子量、芳香性和腐殖化程度。傅里叶变换离子回旋共振质谱(FI-ICR MS)进一步揭示了一些难降解组分，如木质素类和富含羧基的脂环分子(CRAM)是引发丰水期较高 ROS 产生的关键组分，而丰水期较高 ROS 稳态浓度显著缩短了水体中乙草胺降解的半衰

期。本研究提供了一种预测 ROS 产生的新方法，对水位变化下 ROS 介导下污染物的动态变化具有重要的指导意义。

（来源：http://www.niglas.ac.cn/xwdt_1_1/yjjz/202209/t20220930_6519047.html，根据相关资料编译）

业界动态

《长江经济带高质量发展评估研究报告》发布

11 月 26 日《长江经济带高质量发展评估研究报告》（以下简称报告）成果在南京发布。

《中国科学报》从中国科学院南京地理与湖泊研究所获悉，这份报告的完成历时 3 年多，由该所和南京农业大学中国资源环境与发展研究院（中国资政智库）联合组成课题组，深入开展长江经济带高质量发展情况调查研究，进行多视角多维度的科学评估，并针对存在问题提出对策建议。

课题组按照“科学内涵—评估体系—评估结果—问题对策”有机衔接的思路，遵循战略性、引导性、诊断性、实践性的价值导向，在全面准确把握长江经济带高质量发展本质特征基础上，构建涵盖绿色发展、协调发展、开放发展、创新发展、共享发展、安全发展的评估指标体系，以高质量发展指数为主要评估依据，从“经济带—城市群—城市”三个尺度开展评估研究工作。

评估研究发现，长江经济带高质量发展指数十年提升 32.4%，其中创新发展、绿色发展、共享发展等指数得到快速提升，这表明长江经济带的发展方式正在发生快速转变。城市群正成为经济带高质量发展的“主动力”，总体看，长三角城市群高质量发展水平较高，长江中游和成渝城市群高质量发展水平提升相对较快。具体看，长三角城市群高质量发展指数提升 27.6 个百分点，长江中游城市群高质量发展指数提升 33.5 个百分点，成渝城市群高质量发展指数提升 32.8 个百分点。

评估研究证实，城市高质量发展水平与城市等级、发展阶段和战略区位等因素密切相关。其总体特征是，副省级以上及省会城市高于地级城市且排序稳定，下游城市排序高于中上游城市，沿江城市高于非沿江城市，排序上升或下降幅度较大的城市主要集中在中上游地区。副省级以上及省会城市高质量发展指数排序前五名依次为上海、杭州、南京、武汉、宁波。地级城市高质量发展水平位居前列的城市依次为苏州、无锡、嘉兴、绍兴、湖州、常州、舟山、芜湖、马鞍山、台州；排序进位显著的城市有淮南、眉山、娄底、张家界、亳州、衢州、滁州、黄山、衡阳、铜陵等。

报告指出，长江经济带高质量发展水平区域差距仍然明显，尤其是创新发展和开放发展水平区域差异较大，中上游中心城市创新带动能力有待提升，双向联动的开放新格局构建仍需加速，共享发展结构性问题有待解决，安全发展在经济韧性等方面存在薄弱环节。

报告认为，在中国式现代化新征程中深入推动长江经济带高质量发展，要以实现更高水平的人与自然和谐共生、更高水平的区域一体化协同发展、更高水平的对外开放、更强动能

的创新驱动引领、更加健全的多层次社会保障、更具韧性和更加可靠的安全体系为目标，重点要在生态环境共建共治、城乡区域协调发展、对外开放双向联动、产创协同发展、公共服务能力提升、安全保障体系建设等领域系统谋划和协同推进。

（来源： https://news.sciencenet.cn/htmlnews/2022/11/490126.shtm,根据相关资料编译）

中科院报告显示：我国生态环境建设取得巨大成效

中国科学院 12 月 27 日发布资源环境领域系列研究报告，科学分析和揭示了我国湖泊、湿地、山地、西北干旱区、东部超大城市群的长期生态环境变化情况。报告显示，党的十八大以来，上述生态系统和区域的生态环境建设取得巨大成效。

此次发布的系列报告包括：《中国湖泊生态环境研究报告》《中国湿地研究报告》《中国山地研究与山区发展报告》《中国西北干旱区水资源与生态环境研究报告》和《中国东部超大城市群生态环境研究报告》。

中科院副院长张涛介绍，党的十八大以来，我国生态环境保护发生历史性、转折性、全局性变化。中科院组织相关院属单位，集中力量编制形成了系列报告，旨在通过科学系统认识研究对象、驱动科学研究和提供决策咨询，助力推动我国生态环境治理与保护。

报告显示，我国可利用湖库淡水资源总量显著增加，大部分湖泊透明度上升，重要湖泊生物多样性水平稳步提升；我国湿地面积整体呈现恢复态势，湿地生物多样性保护成效显著，湿地碳汇功能显著提升；我国山地生态安全屏障骨干体系基本建成，水土流失防治卓有成效，建成了高效的山地灾害防控体系，山区产业结构得到显著优化。

报告显示，我国西北干旱区水资源节约利用成效显著，用水效率不断提高；节水灌溉面积不断扩大，农业水生产效率显著提高；地表水体面积扩大，水质向好发展。

报告显示，京津冀、长三角和粤港澳大湾区三个城市群生态用地质量稳中有升；大气环境和水环境质量明显改善；资源能源利用效率大幅提升，污染物排放量明显下降；城市生态环境治理能力持续增强。

张涛表示，中科院将持续发挥作为国家战略科技力量的作用，在资源环境领域取得更多成果，为推进美丽中国建设和经济社会高质量发展提供科技支撑。

（来源：https://h.xinhuaxmt.com/vh512/share/11286491?d=1348d2b&channel=weixin，根据相关资料编译）

中国现有 1 平方公里以上天然湖泊 2670 个 总面积逾 8 万平方公里

为贯彻由中国科学院南京地理与湖泊研究所编制的《中国湖泊生态环境研究报告》27 日在北京正式发布，该报告披露，中国现有面积 1 平方公里以上的天然湖泊 2670 个，总面积 8.07 万平方公里，面积 10 平方公里以上湖泊总水量 1.04 万亿立方米。

《中国湖泊生态环境研究报告》显示，中国湖泊生态环境总体状况具有四方面特点：一是可利用湖库淡水资源总量显著增加，湖库对饮用水安全保障的作用更加凸显。除天然湖泊数据外，中国现有水库 9.86 万座，总库容 9306 亿立方米，比 2011 年分别增加 1.01 万座和 2105 亿立方米。受益于湖泊保护和水质改善，全国湖库型集中式饮用水源地占比近 5 年由 33%增加至 40%，服务了全国近 50%的人口。其中，太湖已成为上海重要的饮用水源地，南水北调中线丹江口水库、千岛湖配水工程等重大调水工程为北京、天津、郑州、杭州等提供了优质水源。

二是大部分湖泊透明度上升，发生藻华的湖泊数量减少，湖泊水生植被逐步恢复，湖泊富营养化得到明显遏制。近 10 年来，70%大中型湖泊透明度增加，湖泊整体变清，出现藻华的湖泊数量开始递减，湖泊富营养化得到明显遏制，水质总体状况趋好。

三是重要湖泊生物多样性水平稳步提升。通过生态保护和修复工程的实施，重要湖泊的生态环境趋于好转，生物多样性稳步提升，生态系统完整性和稳定性提高。

四是干旱半干旱区湖泊水量显著增加，湖泊生态服务功能改善。近 10 年来，青海湖水位逐步升高，2020 年平均水位达到 3196 米，为近 50 年来最高水位；呼伦湖面积总体稳定在 2000 平方公里以上；博斯腾湖水量显著增加，从 2012 年的 57.6 亿立方米增加到 2020 年的 81.8 亿立方米，增加了 42%。干旱半干旱区湖泊水位持续上升，湖泊咸化明显改善，对缓解区域水资源短缺、提升湖泊生态服务功能、保障中国北方生态安全发挥了更大作用。

在典型湖泊生态环境状况方面，中国湖泊主要分布在东部平原、云贵高原、青藏高原、蒙新高原和东北平原五大湖区。东部平原以浅水湖泊为主，水源补给充足，河湖关系密切；云贵高原多为断陷深水湖泊，换水周期长，生态系统较为脆弱；青藏高原和蒙新高原以咸水湖和盐湖为主，矿化度高；东北平原湖泊面积较小，大多为浅水湖泊，矿化度较高。东部平原地区典型湖泊太湖、巢湖富营养化得到遏制，鄱阳湖和洪泽湖在水质趋好的同时，生态系统完整性有所提升。

这当中，云贵高原地区典型湖泊滇池和抚仙湖的水质和生态状况明显改善；青藏高原地区典型湖泊青海湖和色林错的蓄水量显著增加，生态系统完整性提升；蒙新高原地区典型湖泊博斯腾湖和呼伦湖的水位和面积恢复，水体咸化明显缓解；东北平原地区典型湖泊查干湖的萎缩与水质恶化趋势得到遏制；水库型典型湖泊千岛湖和天目湖的生态环境总体优良。

为进一步巩固和提升中国湖泊生态环境保护与治理成效，《中国湖泊生态环境研究报告》还提出多项具体建议：一是统筹湖泊生态环境治理与流域综合管控，进一步推动湖泊流域高质量发展；二是大力推进科技湖长制，进一步提升湖泊科学管理和保护水平；三是启动实施国家湖泊生态修复工程，进一步推动湖泊高质量保护；四是加强湖泊流域系统科学研究和技术创新，进一步提升科技支撑能力；五是完善湖泊流域保护机制，推动湖泊保护国家立法。

其中，加强湖泊流域系统科学研究和技术创新上，加强湖泊流域系统基础科学研究，启动第一次全国湖泊普查，为湖泊保护与治理修复提供基础数据；研发湖泊营养盐高效去除与藻类水华控制的革新技术，有效控制湖泊富营养化，在典型湖泊流域开展引领性技术集成应用示范。打造国家级湖泊科学研究中心，构建重点湖泊流域系统监测网络，进一步提升湖泊生态系统感知与模拟能力，研创中国“数字湖泊”，服务湖泊流域综合治理与创新管理。

（来源：http://www.chinanews.com.cn/gn/2022/12-27/9922542.shtml，根据相关资料编译）

生态环境部:长江生物多样性保护取得显著成效

生态环境部召开 11 月例行新闻发布会，生态环境部自然生态保护司司长崔书红表示，自 2020 年 1 月 1 日起，长江流域 332 个自然保护区和水产种质资源保护区全面禁捕；自 2021 年 1 月 1 日起，长江流域重点水域实行十年禁捕；2020 年 12 月，我国第一部流域法律《长江保护法》颁布，为长江生物多样性保护提供了重要法治保障，长江野生物种生境得到极大改善。长江流域已建立保护长江江豚相关的自然保护区 13 处，覆盖了 40%长江江豚的分布水域，保护近 80%的种群。下一步，我们将落实《长江保护法》，落实好长江“十年禁渔”，深入推进水生态系统保护修复，持续推进长江流域珍稀、濒危物种保护。

（来源：https://weibo.com/6059162597/Mh5ZXCfRR?pagetype=profilefeed，根据相关资料编译）

联合国教科文组织：众多标志性世界遗产地冰川将在 2050 年前消失

联合国教科文组织当地时间 11 月 3 日发布的最新研究显示，世界遗产地的冰川正在加速融化，其中三分之一将在 2050 年前消失。这将是 2022 年联合国气候变化会议(COP27)面临的一项主要挑战。

据介绍，在联合国教科文组织的世界遗产地中包含 50 个冰川。这些冰川占地球冰川总面积的近 10%，其状况反映了全球冰川的整体现状。

教科文组织与国际自然保护联盟合作进行的一项新研究表明，由于二氧化碳排放导致的气温升高，这些冰川自 2000 年以来一直在加速消融。目前，它们平均每年损失约 580 亿吨的体量—相当于法国和西班牙每年用水量的总和—并造成全球海平面观测上升量的近 5%。

报告的结论是，无论怎样努力限制温度上升，50 个世界遗产地中冰川的三分之一注定要在 2050 年前消失。但是，如果将全球变暖限制在相对于工业化前水平的 1.5 摄氏度以内，其余三分之二的世界遗产地冰川或能幸免。

联合国教科文组织总干事阿祖莱表示，“这份报告是对行动的呼吁。只有迅速降低二氧化碳排放水平，才能拯救冰川和依赖它们的特有生物多样性。联合国气候变化会议将在寻求这一问题的解决方案方面发挥关键作用。教科文组织坚定支持各国追寻这一目标。”

除了大幅减少碳排放，教科文组织正在倡导建立国际冰川监测和保护基金。这一基金将支持综合研究，优化所有利益相关者之间的交流网络，并实施早期预警和减少灾害风险措施。

国际自然保护联盟总干事奥伯勒博士说，“当冰川迅速融化时，千百万人面临缺水和洪水等自然灾害的风险增加，还有千百万人可能因由此引起的海平面上升而流离失所。这项研究强调了减少温室气体排放和投资基于自然的解决方案的迫切需要，这些举措可以缓解气候变化，使人们更好地适应其影响。”

研究指出，全球半数人口直接或间接依赖冰川作为家庭用水、农业用水和发电用水的来源。冰川也是生物多样性的支柱，滋养着众多生态系统。

（来源：中新网，https://www.chinanews.com.cn/gj/2022/11-04/9886893.shtml，根据相关资料编译）

三位院士领衔发起《全民参与长江大保护倡议书》

11 月 8 日，《湿地公约》第十四届缔约方大会以“共建生命长江、传承大河文明”为主题举办长江大保护论坛。论坛现场，由中国科学院院士曹文宣、桂建芳、王焰新领衔，来自政府、科研、司法、企业、社会组织等长江大保护的多元参与方，共同发起《全民参与长江大保护倡议书》（以下简称《倡议书》）。

中国科学院院士、鱼类生物学家曹文宣是最早呼吁长江“十年禁渔”的科学家，那还是在 2006 年。时至今日，长江“十年禁渔”实施近两年，88 岁的他仍十分关注长江鱼类的生存境况。

在长江干流和大鱼的保护取得阶段性成果之后，曹文宣又将现阶段和下阶段关注的重点放在了长江支流、通江湖泊、消落带以及小鱼的保护上。“水生动物保护也要从小孩子开始，要养成‘鱼也是一种野生动物，同样要加以保护’的理念。”曹文宣呼吁道。

中国科学院院士桂建芳是鱼类遗传育种方面的专家。在他看来，进入 21 世纪后，中国水产养殖的成功，对世界也造成了重要影响，中国绿色生态养殖新范式是可持续的生产方式。因此他呼吁，做好长江大保护，每个人都能从“不吃野生鱼，吃好养殖鱼”做起。

中国科学院院士、中国地质大学（武汉）校长王焰新在“长江大保护”战略实施后，提出了“生态长江”概念，该概念包括生态廊道、生态经济带、全流域的生态治理三大方面。在论坛上，他着重呼吁要让“看不见”的地下水被看见、被重视。

论坛上，三位院士和参与各方共同倡议，秉持“绿水青山就是金山银山”的理念，坚持“共抓大保护，不搞大开发”原则，从生态系统整体性和长江流域系统性着眼，统筹上下游、左右岸、干支流，系统谋划山水林田湖草沙等生态要素，实施好长江生态修复和环境保护工程；严格遵守《湿地保护法》和《长江保护法》，深怀对大自然的敬畏之心，凝聚保护

长江的社会共识，在经济社会发展中始终坚持生态优先、绿色发展，优化产业布局，守住生态安全边界，绘就“人与自然和谐共生”的美好蓝图。

《倡议书》还提出，要加强长江保护管理制度体系建设，强化流域综合管理，实施最严格的水资源保护，落实长江“十年禁渔”，加强湿地生态系统保护修复，提升生态系统质量，发挥生态系统功能；推进社会治理创新，动员更多利益相关方参与，以政府主导，充分调动企业、科研机构、社会组织等社会资源，鼓励各阶层积极主动参与长江大保护行动；推动社会经济发展方式绿色转型，倡导公众积极参与碳达峰、碳中和行动，协同节能减排、减污降碳，提高能效，减少化石能源使用，发展新能源，提升生态碳汇能力；做好长江大保护科普宣教，扩大公众参与面，提高公众关爱长江、保护环境的意识；打造长江生态文化公园，传承和创造新的大河文明；加强科研及协同创新，建立数据共享平台及科技应用考核评价体系，为保护与管理夯实技术支撑，共建智慧生态长江；严厉打击破坏长江生态环境的行为，加强司法机构资源环境审判力度，与企业、社会组织、保护区等合作，共建司法生态保护基地，构建司法力量参与长江大保护新格局。

（来源：央广网，https://www.cnr.cn/hubei/jcgd/20221109/t20221109_526055535.shtml，根据相关资料编译）

江苏省农业双碳重大项目组调研省内大宗淡水鱼养殖基地，切实推进项目实施

2022 年 11 月 15 日至 17 日，依托江苏省碳达峰碳中和科技创新专项资金农业农村领域重大关键技术攻关项目“基于遥感监测的淡水养殖温室气体排放核算与碳氮协同减排关键技术研究”（简称双碳项目），项目首席、中国科学院南京地理与湖泊研究所谷孝鸿研究员带领项目研究团队赴宿迁市、兴化市、常州市、扬中市和张家港市等江苏省现代农业产业大宗淡水鱼推广示范基地开展调研。

调研分别考察了苏南、苏中、苏北不同地区鲫、鲈、鳊、草鱼等大宗淡水鱼单混养模式以及斑点叉尾鮰工程化流水槽养殖模式，系统了解了当前江苏省大宗淡水鱼养殖基础设施、新型饲料、投喂管理、生态养殖技术运用等生产现状及区域差异。在养殖塘口，调研团队就苗种来源、养殖模式、水质调控、病害防治、养殖效益和尾水处置等养殖环节与养殖户进行了深入交流。每到一地调研团队都与当地大宗淡水鱼推广示范基地成员、相关乡镇技术指导员及示范点养殖户代表进行座谈，进一步了解大宗淡水鱼养殖中遇到的瓶颈问题以及地方现实需求。调研中发现，江苏不同地区池塘主养品种、养殖模式和养殖技术差异较大，近年来普遍存在大宗淡水鱼种质资源退化、病害频发、智能化设施普及较慢、养殖环境恶化和尾水处理设施配套不完整等问题，亟待研发新的生态养殖技术和开展高标准生态化鱼塘改造，促进农民增收和保护生态环境。这为双碳项目碳氮协同减排新新技术研发和模式集成示范带来了挑战，也提供了应用场景。

在调研中谷孝鸿特别提醒养殖户和地方技术部门要关注江苏池塘养殖高产量高投入模式下存在的潜在生态危机和鱼类高品质挑战，希望项目组成员认真总结调研中了解的先进技术和发现的问题，围绕项目目标，选择典型养殖模式和养殖品种开展淡水鱼养殖系统温室气体排放源解析和低碳养殖技术研发，进而依托大宗淡水鱼推广示范基地，开展碳氮协同减排和低碳高效淡水养殖模式试验示范，推进流域水产养殖污染治理和水产品品质提升，服务国家“双碳”战略。

（来源：http://www.niglas.cas.cn/xwdt_1_1/zhxw/202211/t20221122_6551747.html，根据相关资料编译）

长期监测显示青海三江源沼泽湿地碳储量增多

11日从三江源国家公园管理局获悉，长期监测显示，近60年来，青海三江源区平均最大积雪深度阶段性变化明显，年最大冻土深度迅速减小，气候生产潜力和植被覆盖度增加，沼泽湿地碳储量增多，河流流量总体增加。

青海三江源是长江、黄河、澜沧江的发源地，是亚洲乃至世界上孕育大江大河最集中的地区之一。三江源国家公园是中国面积最大国家公园，区划总面积19.07万平方公里。

据悉，三江源区年平均气温呈显著增温趋势，1961年-2021年，三江源区年平均气温为1.0℃，且呈显著增温趋势，平均每10年升高0.33℃。此外，三江源区年降水量也呈略增多趋势。

通过监测显示，1961年-2021年，三江源区平均最大积雪深度总体变化趋势不明显，但阶段性变化明显，20世纪80年代中期以前最大积雪深度呈增加趋势，20世纪80年代中期至20世纪末呈减小趋势，进入21世纪以来呈增加趋势。

近60年，三江源区气候生产潜力显著增加，2003年以来增加幅度较大，较1961年-2002年平均增多12.0%。

此外，1981年-2021年，三江源区平均最大冻土深度呈显著减小趋势，平均每10年减小8.4cm，尤其是2017年以来最大冻土深度持续偏小。

在2000年-2021年，三江源区植被覆盖度呈波动增加趋势，平均每年增加0.25%，高植被覆盖度主要分布在三江源区的东南部，而三江源西部主要是低覆盖度分布区。三江源区沼泽湿地总碳储量呈波动增加趋势，其中，2000年-2005年变化趋势不明显，2005年以后呈明显增加趋势。

科研人员表示，未来气候变化持续变暖会给生态系统带来较大风险，建议深化气候变化影响机理研究及极端气象灾害风险评估，提高生态系统对气候变化的适应能力。

（来源：中国新闻网，https://www.chinanews.com/cj/2022/11-11/9892565.shtml，根据相关资料编译）

柴达木盆地最大淡水湖近十年湿地植被恢复 3600 亩

近日从青海省都兰县委宣传部获悉，据最新监测显示，近十年来，柴达木盆地最大淡水湖——阿拉克湖湿地植被恢复 3600 亩，湿地生态系统更加稳定，生物多样性日益丰富。

青海都兰阿拉克湖国家湿地公园位于青海省海西州都兰县南部，属于昆仑山系东部高原腹地，是典型高原亚寒带季风半干旱气候。阿拉克湖总面积 167.99 平方千米，包括湖泊、沼泽及河流三大类湿地，是青海省柴达木盆地最大的淡水湖，储水量 4.9 亿立方米。其地理区位独特，汇聚了多样的生态环境类型，适于多种生物的生存、繁衍，其中包括黑颈鹤、斑头雁、棕头鸥、赤麻鸭、燕鸥和雪豹、盘羊、藏原羚等珍稀野生动植物，是维持柴达木盆地生态平衡、涵养水源、蓄洪防旱、调节径流及珍稀候鸟重要的栖息之地。

都兰县林草局相关负责人介绍，近年来，都兰县加快实施重要生态系统保护和修复重大工程，推进以国家公园为主体的自然保护地体系建设，全面推进都兰县湿地保护事业健康持续发展。

自 2015 年以来，都兰县投入财政资金 1100 万元，建成阿拉克湖国家湿地公园仿古风格管护站 1 座、湿地公园科普场馆 1 座，铺设巡护木栈道 1340 米，观鸟亭(观测台)4 座，完成高原鼠兔防控 50000 亩，湿地植被恢复 3600 亩，湿地公园内的植被得到有效保护和恢复，湿地生态系统更加稳定，生物多样性日益丰富。

同时，阿拉克湖国家湿地公园还设置野生鸟类监测点 8 处、野生动物哺乳类监测点 4 处，野生植物监测点 8 处，并采购动物疫源疫病防护设备，部署 40 套红外相机，配置望远镜、照相机、GPS 定位仪、野外生活设备等，不仅加强了野生动物监测能力，还掌握了野生动物活动情况和栖息环境。

“我们还通过组织护林员全方位深层次定期开展巡护，完成巡护 800 余次，巡护里程达 7000 余公里，守护着阿拉克湖国家湿地公园一片安宁。”都兰县林草局相关负责人说。

都兰县林草局相关负责人表示，除此之外，为提升全民保护湿地、保护野生动物意识，阿拉克湖国家湿地公园还结合“世界湿地日”“爱鸟周”“保护野生动物宣传月”等主题活动，通过线上线下等多种方式加强宣传教育，进一步提高群众保护野生动物、维护生物多样性的生物安全和生态安全意识，营造了人与自然和谐共生的良好氛围。

（来源：科学网，https://news.sciencenet.cn/htmlnews/2022/11/490036.shtm，根据相关资料编译）

滇池蓝藻监控预警系统及平台建设项目顺利通过验收

2022 年 10 月 28 日，南京地湖所承担的滇池“蓝藻监控预警系统及平台建设项目”验收会议在昆明市举行。会议由昆明市滇池高原湖泊研究院（简称“滇池研究院”）杜劲松院长主持，昆明市滇池管理局相关部门参加会议，中国科学院水生生物研究所刘永定院士为专

家组组长。会议听取了项目负责人段洪涛研究员对项目建设和完成情况的汇报，观看了罗菊花副研究员对平台功能的现场演示，审阅了相关验收资料、软件平台等成果。经质询讨论，验收专家组认为该项目完成了合同书规定的研究任务和考核指标，同意通过验收。

滇池水体富营养化水平居高不下，蓝藻水华频繁暴发，水生态、水安全等受到威胁，亟需加强监控预警体系和业务化平台建设，为蓝藻水华应急防控提供决策支撑。本项目围绕蓝藻监测预警需求，整合卫星、无人机、摄像头、浮标、数值模拟等多手段，构建了滇池水质水华“天-空-地”立体监测体系和蓝藻水华预测预警体系，研发了“蓝藻监测预警系统及平台”（简称“平台”），初步实现了对滇池藻华的“现状掌握、异常识别、原因追溯、未来模拟”的目标。平台于 2021 年 3 月底建成并在滇池研究院试运行，迄今已发布藻华卫星监测和预测预警报告 500 余期，为滇池管理局和相关部门掌握蓝藻现状和发展趋势提供了有力支撑。特别是在 2021 年 10 月联合国《生物多样性公约》第十五次缔约方大会在昆明召开期间，该平台发挥了重要作用，为准确研判滇池藻情提供了重要支撑。

与会专家和滇池研究院领导充分肯定了项目建设成果，并希望项目组做好后期的系统维护和人员培训工作，确保该平台能持续支撑滇池研究院的日常业务工作，为滇池蓝藻水华科学防控发挥重要作用。

（来源：http://www.niglas.cas.cn/EngLab/gc_sysdt/gc_zhxw/202211/t20221121_6551479.html，根据相关资料编译）