

# 湖泊科学动态

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- ▢ *Nature Communications*: 北极冻土区热溶喀斯特湖形成加速温室气体释放
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## 热点文章

## Sensitivity of atmospheric CO<sub>2</sub> growth rate to observed changes in terrestrial water storage

Vincent Humphrey, Jakob Zscheischler, Philippe Ciais; et al.

Land ecosystems absorb on average 30 per cent of anthropogenic carbon dioxide (CO<sub>2</sub>) emissions, thereby slowing the increase of CO<sub>2</sub> concentration in the atmosphere<sup>1</sup>. Year-to-year variations in the atmospheric CO<sub>2</sub> growth rate are mostly due to fluctuating carbon uptake by land ecosystems<sup>1</sup>. The sensitivity of these fluctuations to changes in tropical temperature has been well documented<sup>2,3,4,5,6</sup>, but identifying the role of global water availability has proved to be elusive. So far, the only usable proxies for water availability have been time-lagged precipitation anomalies and drought indices<sup>3,4,5</sup>, owing to a lack of direct observations. Here, we use recent observations of terrestrial water storage changes derived from satellite gravimetry<sup>7</sup> to investigate terrestrial water effects on carbon cycle variability at global to regional scales. We show that the CO<sub>2</sub> growth rate is strongly sensitive to observed changes in terrestrial water storage, drier years being associated with faster atmospheric CO<sub>2</sub> growth. We demonstrate that this global relationship is independent of known temperature effects and is underestimated in current carbon cycle models. Our results indicate that interannual fluctuations in terrestrial water storage strongly affect the terrestrial carbon sink and highlight the importance of the interactions between the water and carbon cycles.

(来源: Nature, 2018, DOI: 10.1038/s41586-018-0424-4)

### 中文点评:

#### 陆地水量减少增加大气二氧化碳浓度

近日,《自然》发表题为《大气中二氧化碳增长率对观测到的陆地水储量变化的敏感性》的文章指出,在干旱的年份,由于生态系统从大气中吸收的碳更少,大气中的二氧化碳浓度上升更快。

陆地生态系统平均可吸收 30% 的人为二氧化碳排放,从而减缓了大气中二氧化碳浓度的增加。大气中二氧化碳增长率的年际变化主要是由于陆地生态系统吸收的碳存在波动。已有记录显示这些波动对热带气温变化的敏感性,但是测量全球可利用水的作用相当困难。由于缺乏直接的观察,目前一直使用时间滞后的降水异常和干旱指数等指标来代表生态系统中的可利用水量。虽然这些指标使用方便,但只考虑了水的输入,忽略了由于蒸发和径流造成的水损失。

来自瑞士苏黎世联邦理工学院、法国气候与环境科学实验室和英国埃克塞特大学的研究人员利用最近来自卫星重力测量观测的陆地水储量变化,研究了全球到区域尺度陆地水对碳循环变化的影响。研究发现,大气中二氧化碳的增长率对观测到的陆地水储量变化非常敏感,更干旱的年份与更快的大气二氧化碳增长有关。在干旱的 2015 年,自然生态系统从大气中吸收的碳比正常年份少 30% 左右,而大气中的二氧化碳浓度比正常年份增加更快。相反,在有记录以来最潮湿的 2011 年,大气中二氧化碳浓度的增加速度要慢得多。研究证明:干旱的影响比之前通过植被模型估计的更严重。研究结果表明,陆地水储量的年际波动强烈地

影响陆地碳汇, 强调了水与碳循环相互作用的重要性。

(来源: 中国科学报, 2018-09-26)

## 21st-century modeled permafrost carbon emissions accelerated by abrupt thaw beneath lakes

Katey Walter Anthony, Thomas Schneider von Deimling, Ingmar Nitze; et al.

Permafrost carbon feedback (PCF) modeling has focused on gradual thaw of near-surface permafrost leading to enhanced carbon dioxide and methane emissions that accelerate global climate warming. These state-of-the-art land models have yet to incorporate deeper, abrupt thaw in the PCF. Here we use model data, supported by field observations, radiocarbon dating, and remote sensing, to show that methane and carbon dioxide emissions from abrupt thaw beneath thermokarst lakes will more than double radiative forcing from circumpolar permafrost-soil carbon fluxes this century. Abrupt thaw lake emissions are similar under moderate and high representative concentration pathways (RCP4.5 and RCP8.5), but their relative contribution to the PCF is much larger under the moderate warming scenario. Abrupt thaw accelerates mobilization of deeply frozen, ancient carbon, increasing  $^{14}\text{C}$ -depleted permafrost soil carbon emissions by ~125–190% compared to gradual thaw alone. These findings demonstrate the need to incorporate abrupt thaw processes in earth system models for more comprehensive projection of the PCF this century.

(来源: Nature Communications, 2018, <https://doi.org/10.1038/s41467-018-05738-9>)

### 中文点评:

#### 北极冻土区热溶喀斯特湖形成加速温室气体释放

NASA资助的一项新研究近日发现, 北极永久冻土带消融及由此造成的温室气体释放, 可能会因一个鲜为人知的突然解冻过程而加速。这种突然解冻可能发生在被称为热溶喀斯特的北极湖之下。当深层土壤中的大量冰融化成液态水时, 会形成热溶喀斯特湖。湖泊中的水使得冻土沿海岸融化, 并以比逐渐解冻更快的速度, 扩大湖泊的大小和深度。

这一研究属于NASA为期十年的“北极—北方脆弱性”项目。阿拉斯加大学凯特·沃尔特·安东尼带领的国际团队结合计算机模型和现场测量发现, 与逐渐解冻相比, 突然解冻过程让冻土中储存的古碳释放量增加125%-190%。

北极地区的冰冻土壤里, 储存着世界上最大规模的有机碳, 而随着地球气候不断变暖, 冻土消融, 土壤中的微生物醒来并消化有机物质, 从而将碳转化为温室气体二氧化碳和甲烷, 然后释放到大气中, 导致气候变暖加剧。

更重要的是, 在政府间气候变化专门委员会(IPCC)确定的未来变暖情景预判中, 即便人类减少全球碳排放, 仍可能发生突然解冻导致的大量碳释放。相关成果发表在《自然通讯》上。

(来源: 新华网相关资料, 2018-08-21)

## 摘要精选

## Transience of the North American High Plains landscape and its impact on surface water

Sean D. Willett, Scott W. McCoy, Helen W. Beeson.

Ecosystem diversity and human activity in dry climates depend not just on the magnitude of rainfall, but also on the landscape's ability to retain water. This is illustrated dramatically in the High Plains of North America, where despite the semi-arid modern and past climate, the hydrologic conditions are diverse. Large rivers sourced in the Rocky Mountains cut through elevated plains that exhibit limited river drainage but widespread surface water in the form of ephemeral (seasonal) playa lakes<sup>1</sup>, as well as extensive groundwater hosted in the High Plains aquifer of the Ogallala formations<sup>2</sup>. Here we present a model, with supporting evidence, which shows that the High Plains landscape is currently in a transient state, in which the landscape has bifurcated into an older region with an inefficient river network and a younger, more efficient, river channel network that is progressively cannibalizing the older region. The older landscape represents the remnants of the Ogallala sediments that once covered the entirety of the High Plains, forming depositional fans that buried the pre-existing river network and effectively 'repaved' the High Plains<sup>3,4,5,6</sup>. Today we are witnessing the establishment of a new river network that is dissecting the landscape, capturing channels and eroding these sediment fans. Through quantitative analysis of the geometry of the river network, we show how network reorganization has resulted in a distinctive pattern of erosion, whereby the largest rivers have incised the older surface, removed fan heads near the Rocky Mountains and eroded the fan toes, but left portions of the central fan surface and the Ogallala sediments largely intact. These preserved fan surfaces have poor surface water drainage, and thus retain ephemeral water for wetlands and groundwater recharge. Our findings suggest that the surface hydrology and associated ecosystems are transient features on million-year timescales, and reflect the mode of landscape evolution.

(来源: Nature, 2018, 561: 528-532)

## Hydroclimatic changes of Lake Bosten in Northwest China during the last decades

Junqiang Yao, Yaning Chen, Yong Zhao; et al.

Bosten Lake, the largest inland freshwater lake in China, has experienced drastic change over the past five decades. Based on the lake water balance model and climate elasticity method, we identify annual changes in the lake's water components during 1961–2016 and investigate its water balance. We find a complex pattern in the lake's water: a decrease (1961–1987), a rapid increase (1988–2002), a drastic decrease (2003–2012), and a recent drastic increase (2013–2016). We also estimated the lake's water balance, finding that the drastic changes are caused by a climate-driven regime shift coupled with human disturbance. The changes in the lake accelerated after 1987, which may have been driven by regional climate wetting. During 2003 to 2012, implementation of the ecological water conveyance project (EWCP) significantly increased the lake's outflow, while a decreased precipitation led to an increased drought frequency. The glacier retreating trend accelerated by warming, and caused large variations in the observed lake's changes in recent years. Furthermore, wastewater emissions may give rise to water

degradation, human activity is completely changing the natural water cycle system in the Bosten Lake. Indeed, the future of Bosten Lake is largely dependent on mankind.

(来源: Scientific Reports, 2018, 8(1): 9118-9131)

## **A GIS-based framework for quantifying potential shadow casts on lakes applied to a Danish lake experimental facility**

AndersNielsen, KarstenBolding, DennisTrolle.

We present a Python-based framework for analyzing and quantifying potential shadow casts on lake and reservoir surfaces from the surrounding terrain features. The framework is based on remote sensing data and in this case a detailed Danish nationwide digital elevation model (DEM), which renders not only the physical surface of the terrain, i.e. the topography, but also the elevation of, for instance, buildings and vegetation. We developed a methodological framework encompassing existing computational routines embedded in the open source QGIS platform as well as existing computational packages available for Python, which collectively enable calculation of shadow casts from all elements surrounding a lake or a reservoir surface. Our framework is demonstrated through application to a Danish lake experimental facility but may be used for lakes or reservoirs world-wide to evaluate if shadow casts need to be considered and accounted for in modelling studies by correction of e.g. radiation inputs.

(来源: Int. J. Appl. Earth Obs. Geoinf., 2018, 73: 746-751)

## **A soft-classification-based chlorophyll-a estimation method using MERIS data in the highly turbid and eutrophic Taihu Lake**

Fangfang Zhang, Junsheng Li, Qian Shen; et al.

Soft-classification-based methods for estimating chlorophyll-a concentration (Cchl<sub>a</sub>) by satellite remote sensing have shown great potential in turbid coastal and inland waters. However, one of the most important water color sensors, the MEdium Resolution Imaging Spectrometer (MERIS), has not been applied to the study of turbid or eutrophic lakes. In this study, we developed a new soft-classification-based Cchl<sub>a</sub> estimation method using MERIS data for the highly turbid and eutrophic Taihu Lake. We first developed a decision tree to classify Taihu Lake into three optical water types (OWTs) using MERIS reflectance data, which were quasi-synchronous ( $\pm 3$  h) with in situ measured Cchl<sub>a</sub> data from 91 sample stations. Secondly, we used MERIS reflectance and in situ measured Cchl<sub>a</sub> data in each OWT to calibrate the optimal Cchl<sub>a</sub> estimation model for each OWT. We then developed a soft-classification-based Cchl<sub>a</sub> estimation method, which blends the Cchl<sub>a</sub> estimation results in each OWT by a weighted average, where the weight for each MERIS spectra in each OWT is the reciprocal value of the spectral angle distance between the MERIS spectra and the centroid spectra of the OWT. Finally, the soft-classification based Cchl<sub>a</sub> estimation algorithm was validated and compared with no-classification and hard-classification-based methods by the leave-one-out cross-validation (LOOCV) method. The soft-classification-based method exhibited the best performance, with a correlation coefficient ( $R^2$ ), average relative error (ARE), and root-mean-square error (RMSE) of 0.81, 33.8%, and 7.0  $\mu\text{g/L}$ , respectively. Furthermore, the soft-classification-based method displayed smooth values at the edges of OWT boundaries, which resolved the main problem with the hard-classification-based method. The seasonal and annual variations of Cchl<sub>a</sub> were computed in Taihu Lake from 2003 to 2011, and

agreed with the results of previous studies, further indicating the stability of the algorithm. We therefore propose that the soft-classification-based method can be effectively used in Taihu Lake, and that it has the potential for use in other optically-similar turbid and eutrophic lakes, and using spectrally-similar satellite sensors.

(来源: Int. J. Appl. Earth Obs. Geoinf., 2018, doi:10.1016/j.jag.2018.07.018)

## A long-term decrease in the persistence of soil carbon caused by ancient Maya land use

Peter M. J. Douglas, Mark Pagani, Timothy I. Eglinton; et al.

The long-term effects of deforestation on tropical forest soil carbon reservoirs are important for estimating the consequences of land use on the global carbon cycle, but are poorly understood. The Maya Lowlands of Mexico and Guatemala provide a unique opportunity to assess this question, given the widespread deforestation by the ancient Maya that began ~4,000 years ago. Here, we compare radiocarbon ages of plant waxes and macrofossils in sediment cores from three lakes in the Maya Lowlands to record past changes in the mean soil transit time of plant waxes (MTTwax). MTTwax indicates the average age of plant waxes that are transported from soils to lake sediments, and comparison of radiocarbon data from soils and lake sediments within the same catchment indicates that MTTwax reflects the age of carbon in deep soils. All three sediment cores showed a decrease in MTTwax, ranging from 2,300 to 800 years, over the past 3,500 years. This decrease in MTTwax, indicating shorter storage times for carbon in lake catchment soils, is associated with evidence for ancient Maya deforestation. MTTwax never recovered to pre-deforestation values, despite subsequent reforestation, implying that current tropical deforestation will have long-lasting effects on soil carbon sinks.

(来源: Nature Geoscience, 2018,11:645-649)

## How autochthonous dissolved organic matter responds to eutrophication and climate warming: Evidence from a cross-continental data analysis and experiments

YongqiangZhou, Thomas A.Davidson, XiaolongYao; et al.

Harmful algal blooms have become increasingly frequent due to the dual pressure of excessive nutrient loading and climate change in recent years. Algal-derived dissolved organic matter (DOM) is a potentially large component of the labile organic matter pool, and also climate warming may affect the DOM pool, although the results on the latter so far are equivocal. The question of how eutrophication and climate warming may drive the accumulation of autochthonous DOM is much debated. Here, we analysed published data on DOM world-wide and field data that we collected from 97 lakes and major rivers in China (> 4500 samples) as well as results from the longest running shallow-lake mesocosm climate experiment in the world at a research facility in Denmark. Our results indicated that dissolved organic carbon (DOC) concentrations decreased with increasing temperature and enrichment of  $\delta^{13}\text{C}$ -DOM. A negative relationship was found between latitude and %protein-like fluorescence, which increased significantly with increasing elevation and enrichment of  $\delta^{13}\text{C}$ -DOM. Specific ultraviolet absorbance at 254 nm (SUVA) decreased with increasing elevation and enrichment of  $\delta^{13}\text{C}$ -DOM. Fluorescence

intensity of autochthonous microbial humic-like substances increased notably with eutrophication but decreased weakly with warming. DOC, biodegradable DOC, chlorophyll-a,  $\delta^{13}\text{C}$ -DOC and autochthonous substances identified using DOM fluorescence and high resolution mass spectrometry from the mesocosm experiment were notably elevated at the high nutrient levels, while the effect of temperature was insignificant. We conclude that while eutrophication promotes DOM, warming potentially suppresses the accumulation of autochthonous DOM in inland waters.

(来源: Earth-Science Reviews, 2018, <https://doi.org/10.1016/j.earscirev.2018.08.013>)

## Accumulation of Terrestrial Dissolved Organic Matter Potentially Enhances Dissolved Methane Levels in Eutrophic Lake Taihu, China

Y Zhou, Q Xiao, X Yao; et al.

Inland waters play an important role for the storage of chromophoric dissolved organic matter (CDOM) and outgassing of methane ( $\text{CH}_4$ ). However, to date, linkages between the optical dynamics of CDOM and dissolved  $\text{CH}_4$  levels remain largely unknown. We used multi-year (2012-2014) seasonal data series collected from Lake Taihu and 51 connecting channels to investigate how CDOM optical dynamics may impact dissolved  $\text{CH}_4$  levels in the lake. High dissolved  $\text{CH}_4$  in the northwestern inflowing river mouths coincided with high underwater UV-vis light availability, dissolved organic carbon (DOC), chemical oxygen demand (COD), DOM aromaticity, terrestrial humic-rich fluorescence, in situ measured terrestrial CDOM, depleted dissolved oxygen (DO), stable isotopic  $\delta^2\text{H}$ , and  $\delta^{18}\text{O}$  compared with other lake regions. Our results further revealed positive relationships between dissolved  $\text{CH}_4$  and CDOM absorption at 350 nm, i.e.  $a(350)$ , COD, DOC, terrestrial humic-rich fluorophores, and DOM aromaticity, and negative relationships between dissolved  $\text{CH}_4$  and DO,  $\delta^2\text{H}$ , and  $\delta^{18}\text{O}$ . The central lake samples showed a major contribution of terrestrial-sourced molecular formulas to the ultrahigh resolution mass spectrometry data, suggesting the presence of allochthonous DOM sources even here. We conclude that an elevated terrestrial CDOM input likely enhances dissolved  $\text{CH}_4$  levels in Lake Taihu.

(来源: Environmental science & technology, 2018, 52(18):10297-10306)

## Dissolved greenhouse gas concentrations in 40 lakes in the Alpine area

Pighini, Sylvie; Ventura, Maurizio; Miglietta, Franco; et al.

While it has been recently recognized that freshwater ecosystems may significantly offset the terrestrial carbon sink through emissions of carbon dioxide ( $\text{CO}_2$ ) and methane ( $\text{CH}_4$ ), empirical data on the magnitude of these sources are still scarce, in particular in temperate regions. In this study, we measured the near-surface dissolved concentrations of  $\text{CH}_4$  and  $\text{CO}_2$  from 40 lakes in the Alpine area to estimate their potential for greenhouse gas (GHG) emissions. We hypothesized (1) a temperature-driven gradient of dissolved gas concentrations in terms of elevation and latitude of the lakes and (2) that lower concentrations would be measured in man-made reservoirs compared to natural lakes. Average  $\text{CH}_4$  and  $\text{CO}_2$  surface dissolved concentrations amounted to  $1.10 \pm 1.30$  and  $36.23 \pm 31.15 \mu\text{mol L}^{-1}$ , respectively. All the lakes, except for one, were supersaturated, exceeding ambient atmospheric  $\text{CH}_4$  and  $\text{CO}_2$  concentrations by a factor of  $400 \pm 424$  and  $2.43 \pm 2.29$ , respectively. Consistent with our hypothesis, we found lower surface dissolved GHG concentrations in man-made reservoirs compared to natural lakes, which was shown to be related to their greater depth. Even though temperature is known to

affect multiple physico-chemical and biological processes governing the strength of the uptake, release and conversion of CH<sub>4</sub> and CO<sub>2</sub>, and temperature is inversely related to elevation, no relationship between dissolved GHG concentrations and elevation could be determined. This is believed to be the result of the overriding importance of lake depth for near-surface CH<sub>4</sub> concentrations and the lack of explanatory variables related to lake carbon cycling. Overall, this study suggests that lakes in the Alpine region act as sources of CO<sub>2</sub> and CH<sub>4</sub> to the atmosphere and that further research should be carried out to quantify the actual GHG emissions from Alpine freshwater bodies and how these are affected by ongoing changes in climate and land use.

(来源: AQUATIC SCIENCES, 2018, 80(3): 32)

## Dissolved carbon in a large variety of lakes across five limnetic regions in China

Song, Kaishan; Wen, Zhidan; Xu, Yijun; et al.

Dissolved carbon in lakes play a vital role in the global carbon cycling. The concentration and dynamics of lake dissolved carbon can be influenced by both the surrounding landscape and a combination of physical, chemical and biological processes within the lakes themselves. From 2009 to 2016, we conducted a large-scale assessment of dissolved organic carbon (DOC) and dissolved inorganic carbon (DIC) in 249 lakes across a diverse range of climatic, geopedologic, topographical and hydrological conditions in five Chinese limnetic regions: the East Limnetic Region (ELR), the Northeast Limnetic Region (NLR), the Inner Mongolia-Xinjiang Limnetic Region (MXR), the Yungui Limnetic Region (YGR), and the Tibet-Qinghai Limnetic Region (TQR). We found that the density of the organic matter in the soil in the surrounding landscape plays an important role in the DOC and DIC in lake water, as was evidenced by the high DOC and DIC levels in the NLR, where the soil is respectively organically rich. Conditions in the arid and semi-arid environments (i.e. TQR and MXR) have created a number of brackish/saline lakes and here we found that, DOC and DIC levels (median: 21.79 and 93.72 mg/L, respectively) are significantly higher than those in the freshwater lakes (median: 5.80 and 29.38 mg/L). It also appears to be the case that the trophic state of freshwater lakes influences the spatial variation of DOC. This can be seen in the relationships between DOC and trophic state index (TSI) in agriculturally-dominated regions such as the ELR ( $R^2 = 0.59$ ,  $p < 0.01$ ), NLR ( $R^2 = 0.65$ ,  $p < 0.001$ ), and YGR ( $R^2 = 0.78$ ,  $p < 0.001$ ). Additionally, a close relationship between DOC and DIC can be found in lake waters with different trophic states (eutrophic:  $slp = 0.63$ ,  $R^2 = 0.69$ ; mesotrophic:  $slp = 1.03$ ,  $R^2 = 0.65$ ; oligotrophic:  $slp = 1.00$ ,  $R^2 = 0.64$ ). This indicates that human activities influence the quantity and quality of dissolved carbon in inland water across China. This study is able to provide insights regarding the potential effects of climate change and changes in land-use upon the amount of dissolved carbon in lake water.

(来源: JOURNAL OF HYDROLOGY, 2018, 563:143-154)

## Determining major factors controlling phosphorus removal by promising adsorbents used for lake restoration: A linear mixed model approach

Funes, A.; Martinez, F. J.; Alvarez-Manzaneda, I.; et al.

Phosphorus (P) removal from lake/drainage waters by novel adsorbents may be affected by competitive substances naturally present in the aqueous media. Up to date, the effect of interfering substances has been studied basically on simple matrices (single-factor effects) or by applying basic statistical approaches when using natural lake water. In this study, we determined major factors controlling P removal efficiency in 20 aquatic ecosystems in the southeast Spain by using linear mixed models (LMMs). Two non-magnetic-CFH-12 (R) and Phoslock (R)- and two magnetic materials-hydrous lanthanum oxide loaded silica-coated magnetite (Fe-Si-La) and commercial zero-valent iron particles (FeHQ)- were tested to remove P at two adsorbent dosages. Results showed that the type of adsorbent, the adsorbent dosage and color of water (indicative of humic substances) are major factors controlling P removal efficiency. Differences in physico-chemical properties (i.e. surface charge or specific surface), composition and structure explain differences in maximum P adsorption capacity and performance of the adsorbents when competitive ions are present. The highest P removal efficiency, independently on whether the adsorbent dosage was low or high, were 85-100% for Phoslock and CFH-12 (R), 70-100% for Fe-Si-La and 0-15% for FeHQ. The low dosage of FeHQ compared to previous studies, explained its low P removal efficiency. Although non-magnetic materials were the most efficient, magnetic adsorbents (especially Fe Si -La) could be proposed for P removal as they can be recovered along with P and be reused, potentially making them more profitable in a long-term period.

(来源: WATER RESEARCH, 2018, 141: 377-386)

## Limitations on using CDOM as a proxy for DOC in temperate lakes

Griffin, Claire G; Finlay, Jacques C; Brezonik, Patrick L; et al.

Colored dissolved organic matter (CDOM) has been widely studied as part of efforts to improve understanding of the aquatic carbon cycle, by laboratory, in situ, and remote sensing methods. We studied ecoregion-scale differences in CDOM and dissolved organic carbon (DOC) to understand variability in organic matter composition and the use of CDOM as a proxy for DOC. Data from 299 lakes across the U.S. Upper Midwest showed that CDOM, measured as absorptivity at 440 nm ( $a_{440}$ ), correlated strongly with DOC ( $R^2 = 0.81$ ,  $n = 412$ ). Colored lakes in the Northern Lakes and Forests (NLF) ecoregion drove this relationship. Lakes in the North Central Hardwood Forests (NCHF) had low color (most had  $a_{440} < 3 \text{ m}^{-1}$ ) and weaker CDOM-DOC relationships ( $R^2 = 0.47$ ). Spectral slopes and specific ultraviolet absorbance (SUVA), indicated relatively low aromaticity and non-terrestrial DOM sources in low color lakes. Multiple regression analyses that included total dissolved nitrogen (TDN) and CDOM, but not chlorophyll *a*, improved DOC estimates in low color lakes, suggesting a dominant contribution of non-planktonic sources of low color DOM in these lakes. Our results show that CDOM is a reliable, regional proxy for DOC in lakes where forests and wetlands dominate the landscape and the DOM is primarily terrestrial in origin. Mapping of lake DOC at broad spatial scales by satellite-derived CDOM has lower accuracy in low color lakes.

(来源: WATER RESEARCH, 2018, 144: 719-727)

## Ubiquitous and significant anaerobic oxidation of methane in freshwater lake sediments

Martinez-Cruz, Karla; Sepulveda-Jauregui, Armando; Casper, Peter; et al.

Anaerobic oxidation of methane (AOM) is a microbial process that consumes dissolved methane (CH<sub>4</sub>) in anoxic sediments and soils and mitigates CH<sub>4</sub> release to the atmosphere. The degree to which AOM limits global biospheric CH<sub>4</sub> emissions is not fully understood. In marine sediments, where the process was first described, AOM is responsible for oxidizing >90% of the CH<sub>4</sub> produced. More recently, AOM has been observed in soils, peatlands, and freshwater ecosystems. In lakes, where sediment anoxia, organic carbon turnover, and CH<sub>4</sub> production are common, AOM is not well studied but could represent a significant CH<sub>4</sub> sink and constraint on emissions. Here, we present evidence for the occurrence of AOM in the sediment of thirteen lakes that span a global climatic and trophic gradient. We further quantified and modeled AOM patterns and studied potential microbial controls of AOM using laboratory incubations of sediment and stable isotope measurements in three of the thirteen lakes. We demonstrate that AOM is widespread in freshwater lake sediments and accounts for 29%-34% (95% confidence interval) of the mean total CH<sub>4</sub> produced in surface and near-surface lake sediments.

(来源: WATER RESEARCH, 2018, 144: 332-340)

## The spatial extent of the East Asian summer monsoon in arid NW China during the Holocene and Last Interglaciation

Guoqiang Li, Linlin She, MingJin; et al.

The extent to which the East Asian summer monsoon (EASM) penetrated inland during the last interglacial cycle and the Holocene remains unclear, but it is critical to understanding changing precipitation dynamics in arid NW China. Here we reconstruct high-resolution lake level changes for two closed terminal lake basins in the eastern and western Alxa Plateau (AP) at the fringe of the modern EASM. Nineteen well-preserved paleolake shoreline sequences at these two basins were systematically investigated and trenched. The chronologies for these shorelines were constructed using quartz optically stimulated luminescence dating and K-feldspar pIRIR dating. Our results indicate that: (1) lake high stands occurred in both basins of the AP during Marine Isotope Stage (MIS) 5 and the mid-late Holocene; (2) paleolake level fluctuations on the eastern and western AP are asynchronous within these two periods. Lake levels peaked in the eastern AP during MIS 5e to 5c and the mid-Holocene, while the highest lake levels occurred in the western AP during MIS 5c to 5a and the late Holocene; (3) lake level changes in the eastern AP were contemporaneous with changes in EASM intensities during MIS 5 and the Holocene, while those in the western AP were asynchronous. These differences indicate EASM-precipitation was more intense on the eastern AP during periods of maximum EASM strength. Conversely, relative aridity in the western AP indicates that the EASM did not penetrate that far inland even during phases of strong monsoonal circulation (i.e. early MIS 5 and the mid-Holocene). Instead, precipitation and lake level changes in the western AP and much of the northeastern Tibetan Plateau appears to be related to changing meridional circulation intensity (Westerlies).

(来源: Global and Planetary Change, 2018, 169: 48-65)

## Distinguishing brackish lacustrine from brackish marine deposits in the stratigraphic record: A case study from the late Miocene and early Pliocene Bouse Formation, Arizona and California, USA

JordonBright, Andrew S.Cohen, Scott W.Starratt.

Brackish marine and brackish continental environments are fundamentally different from a compositional perspective. Brackish water is often defined as having salinity lower than that of standard seawater but higher than that of freshwater, but less regard is given to the origin of the salts involved. The simple dilution of standard seawater by freshwater in a coastal or estuarine setting constitutes a brackish environment, but so do lakes where continental fresh water is impounded and becomes more saline through a variety of solute evolution pathways. The range of potential compositions of brackish lake water is diverse and includes water with “seawater-like” compositions. Isolated brackish lake environments located hundreds of kilometers inland can evolve towards sodium chloride-dominated, low alkalinity environments that mimic the composition of brackish seawater environments. These types of lakes can harbor a variety of continentally invasive but typically marine organisms, including but not limited to algae, foraminifers, mollusks, diatoms, and crustaceans. Distinguishing brackish marine from brackish lake environments in the geologic record can be difficult. In this paper, the enigmatic late Miocene and early Pliocene southern Bouse Formation of southern Arizona and California, USA, considered by many to represent a marine transgression along the lower Colorado River corridor, is discussed within a broad framework that incorporates hydrochemical, biogeographical, and species niche concepts. A brackish lake interpretation provides a powerful platform that can comprehensively account for the enigmatic mixed marine and continental fossil assemblage and possible tidal rhythmites that feature prominently in the southern Bouse Formation controversy. A review of the broader regional (paleo)environmental context for the southern Bouse supports a sodium chloride-dominated, low alkalinity, mildly brackish (10-5 ppt) Colorado River-fed lake depositional environment that was populated by an intriguing but predictable array of euryhaline, opportunistic, and continentally invasive marginal marine organisms.

(来源: Earth-Science Reviews, 2018, 185: 928-937)

## Lacustrine mineral magnetic record of postglacial environmental changes from Dahu Swamp, southern China

Z Wei, W Zhong, S Shang; et al.

Systematic studies of lacustrine magnetic sediments can provide useful information to decipher the catchment processes of specific environmental changes. To explore the magnetic mineral-paleoenvironment connections, we have conducted a mineral-magnetic investigation on a lacustrine sediment core recovered from a closed-basin lake in the eastern Nanling Mountains of southern China. Our results show that the magnetic minerals in the sediments were mainly catchment-derived, and the post-depositional effects, or biogenic and authigenic growth of secondary ferrimagnetic minerals, were probably insignificant or absent. The catchment soil erosion, pedogenic development, and vegetation coverage are interpreted as the main forcing in controlling the variations in magnetic parameters. During the last deglaciation period (~16,500–11,100 yr BP), the relatively high and significant variations in magnetic parameters of sediments could have corresponded to the rapid climate fluctuations after the cool and dry Last Glacial Maximum. In the Holocene (11,100 yr BP to present), the low magnetic concentrations and increases in finer magnetic particles likely resulted from the stabilization of the watershed and more intense pedogenic processes under the warm and wet climate. Because changes in surface-runoff, vegetation coverage, and soil pedogenic processes are closely related to Asian summer monsoon (ASM) intensity, the sedimentary magnetism of Dahu Swamp can provide another valuable source of information to investigate the development of the ASM in southern

China.

(来源: Global and Planetary Change, 2018, 170: 62-75)

## Lake sediment fecal and biomass burning biomarkers provide direct evidence for prehistoric human-lit fires in New Zealand

E. Argiriadis, D. Battistel, D. B. McWethy; et al.

Deforestation associated with the initial settlement of New Zealand is a dramatic example of how humans can alter landscapes through fire. However, evidence linking early human presence and land-cover change is inferential in most continental sites. We employed a multi-proxy approach to reconstruct anthropogenic land use in New Zealand's South Island over the last millennium using fecal and plant sterols as indicators of human activity and monosaccharide anhydrides, polycyclic aromatic hydrocarbons, charcoal and pollen as tracers of fire and vegetation change in lake-sediment cores. Our data provide a direct record of local human presence in Lake Kirkpatrick and Lake Diamond watersheds at the time of deforestation and a new and stronger case of human agency linked with forest clearance. The first detection of human presence matches charcoal and biomarker evidence for initial burning at c. AD 1350. Sterols decreased shortly after to values suggesting the sporadic presence of people and then rose to unprecedented levels after the European settlement. Our results confirm that initial human arrival in New Zealand was associated with brief and intense burning activities. Testing our approach in a context of well-established fire history provides a new tool for understanding cause-effect relationships in more complex continental reconstructions.

(来源: Scientific Reports, 2018, doi:10.1038/s41598-018-30606-3)

## Climate, Fire, and Vegetation Mediate Mercury Delivery to Midlatitude Lakes over the Holocene

Pompeani, David P.; Cooke, Colin A.; Abbott, Mark B.; et al.

The rise in mercury concentrations in lake sediment deposited over the last similar to 150 years is widely recognized to have resulted from human activity. However, few studies in the Great Lakes region have used lake sediment to reconstruct atmospheric mercury deposition on millennial time scales. Here we present a 9000-year mercury record from sediment in Copper Falls; a small closed-basin lake on the Keweenaw Peninsula. Prior to abrupt increases in the 19th and 20th centuries, mercury remains at relatively low concentrations for the last 9000 years. Higher mercury fluxes in the early Holocene ( $3.4 \pm 1.1 \mu\text{g m}^{-2} \text{yr}^{-1}$ ) are attributed to drier conditions and greater forest fire occurrence. The gradual decline in mercury flux over the middle to late Holocene ( $1.9 \pm 0.2 \mu\text{g m}^{-2} \text{yr}^{-1}$ ) is interpreted to reflect a transition to wetter conditions, which reduced forest fires, and promoted the development of soil organic matter and deciduous forests that sequestered natural sources of mercury. The Copper Falls Lake record highlights the sensitivity of watersheds to changes in mercury inputs from both human and natural forcings, and provides millennial-scale context for recent mercury contamination that will aid in establishing baseline values for restoration efforts.

(来源: Environmental science & technology, 2018, 52(15): 8157-8164)

## Rapid change in East Antarctic terrestrial vegetation in response to regional drying

Sharon A. Robinson, Diana H. King, Jessica Bramley-Alves; et al.

East Antarctica has shown little evidence of warming to date<sup>1,2,3</sup> with no coherent picture of how climate change is affecting vegetation<sup>4,5,6</sup>. In stark contrast, the Antarctic Peninsula experienced some of the most rapid warming on the planet at the end of the last century<sup>2,3,7,8</sup> causing changes to the growth and distribution of plants<sup>9,10,11</sup>. Here, we show that vegetation in the Windmill Islands, East Antarctica is changing rapidly in response to a drying climate. This drying trend is evident across the region, as demonstrated by changes in isotopic signatures measured along moss shoots<sup>12,13</sup>, moss community composition and declining health, as well as long-term observations of lake salinity<sup>14</sup> and weather. The regional drying is possibly due to the more positive Southern Annular Mode in recent decades. The more positive Southern Annular Mode is a consequence of Antarctic ozone depletion and increased greenhouse gases, and causes strong westerly winds to circulate closer to the continent, maintaining colder temperatures in East Antarctica despite the increasing global average<sup>15,16,17,18</sup>. Colder summers in this region probably result in reduced snow melt and increased aridity. We demonstrate that rapid vegetation change is occurring in East Antarctica and that its mosses provide potentially important proxies for monitoring coastal climate change.

(来源: Nature Climate Change, 2018, doi:10.1038/s41558-018-0280-0)

## Assessing the ecological role of water level fluctuations on sedimentary information in a shallow lake

Guo, Tong; Chen, He.

The relationship between water level and biodiversity of aquatic plants has been broadly identified but not so frequently quantified, especially with regard to historical periods. We reconstructed historical water levels with decadal resolution and assessed the response of individual aquatic plant species and plant diversity to water level. Our analyses were based on diatoms and plant pollen preserved in sediments of a shallow lake. We disentangled the effects of physical and chemical components on the composition of diatom assemblages in the process of reconstructing water level. The results showed that water levels indicated compositional changes in sedimentary diatom assemblages in different time periods. Diatom assemblages in the lower sediment layers present a larger compositional change than the upper ones. Moreover, water level was linked to the abundance of aquatic vascular plants, especially the submerged macrophytes based on grey analysis. Data on both sedimentary abiotic parameters and annual precipitation indicated that water level had large temporal variations in the earlier time periods of lake formation. However, water level experienced a sharp decrease and tended to be less variable after the construction of water dams. The optimal water levels related to plant diversity were determined at 6.95 m and at 8.24 m based on the richness and the evenness of seven species which were indicative of water level. The latter included six diatom species (*Eunotia pectinalis*, *Pseudostautosira brevistriata*, *Cymbella cornuta*, *Cyclotella meneghiniana*, *Nitzschia palea* and *Gomphonema gracile*) and one submerged plant (*Myriophyllum*). Extremely high or low water levels dampened the diversity of aquatic plants. Obtaining long-term lake water levels and analyzing their relation with biotic and abiotic components help us to understand impacts of anthropogenic disturbance on shallow lakes and thus contribute to the maintenance of aquatic plant diversity.

(来源: FUNDAMENTAL AND APPLIED LIMNOLOGY, 2018, 191(3): 223-237)

## Multiple stressors trigger ecological changes in tropical Lake La Tembladera (Ecuador)

Lopez-Blanco, Charo; Kenney, William F.; Varas, Andres; et al.

We examined the relationship between cladoceran, limnological, geological and biological variables in a recent sediment sequence to assess the cladoceran community response to flood conditions and human impacts during the last century in shallow Lake La Tembladera, on the southern coast of Ecuador. We recovered three sediment cores from central and littoral locations to analyze cladoceran subfossils and plant macrofossils. Redundancy analysis identified three environmental variables controlling the assemblage composition: the presence of non-aquatic plants, As and Be concentrations in the sediment. Before AD 1925, the surface area of the lake was smaller than it is now and the most representative cladocerans were Euryalona at lower lake levels and Leydigiopsis at relatively higher lake levels. After ca. AD 1925, anthropogenic works increased the lake level and the expanse of the littoral zone, favoring phytophilous cladocerans such as Kurzia. Around ca. AD 1990, the disposal of mining tailings contaminated with arsenic increased cladoceran sexual reproduction (total chydorid ephippia) and favored certain taxa. Our study shows the influence of anthropogenic activities on hydrologic regime, lake stage and heavy metal contamination and our results indicate the environmental trajectory of this lake, as it shifted from more natural to more impacted conditions in the last century.

(来源: AQUATIC ECOLOGY, 2018, 52(2-3): 211-224)

## Phylogenomics uncovers early hybridization and adaptive loci shaping the radiation of Lake Tanganyika cichlid fishes

Iker Irisarri, Pooja Singh, Stephan Koblmüller; et al.

Lake Tanganyika is the oldest and phenotypically most diverse of the three East African cichlid fish adaptive radiations. It is also the cradle for the younger parallel haplochromine cichlid radiations in Lakes Malawi and Victoria. Despite its evolutionary significance, the relationships among the main Lake Tanganyika lineages remained unresolved, as did the general timescale of cichlid evolution. Here, we disentangle the deep phylogenetic structure of the Lake Tanganyika radiation using anchored phylogenomics and uncover hybridization at its base, as well as early in the haplochromine radiation. This suggests that hybridization might have facilitated these speciation bursts. Time-calibrated trees support that the radiation of Tanganyika cichlids coincided with lake formation and that Gondwanan vicariance concurred with the earliest splits in the cichlid family tree. Genes linked to key innovations show signals of introgression or positive selection following colonization of lake habitats and species' dietary adaptations are revealed as major drivers of colour vision evolution. These findings shed light onto the processes shaping the evolution of adaptive radiations.

(来源: Nature Communication, 2018, doi:10.1038/s41467-018-05479-9)

## Microbial connectivity and sorting in a High Arctic watershed

Jérôme Comte, Alexander I. Culley, Connie Lovejoy; et al.

Aquatic ecosystems in the High Arctic are facing unprecedented changes as a result of global warming effects on the cryosphere. Snow pack is a central feature of northern landscapes, but the snow microbiome and its microbial connectivity to adjacent and downstream habitats have been little explored. To evaluate these aspects, we sampled along a hydrologic continuum at Ward Hunt Lake (latitude 83°N) in the Canadian High Arctic, from snow banks, water tracks in the permafrost catchment, the upper and lower strata of the lake, and the lake outlet and its coastal marine mixing zone. The microbial communities were analyzed by high-throughput sequencing of 16 and 18S rRNA to determine the composition of potentially active Bacteria, Archaea and microbial Eukarya. Each habitat had distinct microbial assemblages, with highest species richness in the subsurface water tracks that connected the melting snow to the lake. However, up to 30% of phylotypes were shared along the hydrologic continuum, showing that many taxa originating from the snow can remain in the active fraction of downstream microbiomes. The results imply that changes in snowfall associated with climate warming will affect microbial community structure throughout all spatially connected habitats within snow-fed polar ecosystems.

(来源: The ISME Journal, 2018, <https://doi.org/10.1038/s41396-018-0236-4>)

## Characterization, origin and aggregation behavior of colloids in eutrophic shallow lake

Xu, Huacheng; Xu, Mengwen; Li, Yani; et al.

Stability of colloidal particles contributes to the turbidity in the water column, which significantly influences water quality and ecological functions in aquatic environments especially shallow lakes. Here we report characterization, origin and aggregation behavior of aquatic colloids, including natural colloidal particles (NCPs) and total inorganic colloidal particles (TICPs), in a highly turbid shallow lake, via field observations, simulation experiments, ultrafiltration, spectral and microscopic, and light scattering techniques. The colloidal particles were characterized with various shapes (spherical, polygonal and elliptical) and aluminum-, silicon-, and ferric-containing mineralogical structures, with a size range of 20-200 nm. The process of sediment re-suspension under environmentally relevant conditions contributed 78-80% of TICPs and 54-55% of NCPs in Lake Taihu, representing an important source of colloids in the water column. Both mono- and divalent electrolytes enhanced colloidal aggregation, while a reverse trend was observed in the presence of natural organic matter (NOM). The influence of NOM on colloidal stability was highly related to molecular weight (MW) properties with the high MW fraction exhibiting higher stability efficiency than the low MW counterparts. However, the MW-dependent aggregation behavior for NCPs was less significant than that for TICPs, implying that previous results on colloidal behavior using model inorganic colloids alone should be reevaluated. Further studies are needed to better understand the mobility/stability and transformation of aquatic colloids and their role in governing the fate and transport of pollutants in natural waters.

(来源: WATER RESEARCH, 2018, 142: 176-186)

## Seasonal Gene Expression and the Ecophysiological Implications of Toxic *Microcystis aeruginosa* Blooms in Lake Taihu

Tang, Xiangming; Krausfeldt, Lauren E; Shao, Keqiang; et al.

Harmful cyanobacterial blooms represent an increasing threat to freshwater resources globally. Despite increased research, the physiological basis of how the dominant bloom-forming cyanobacteria, *Microcystis* spp., proliferate and then maintain high population densities through changing environmental conditions is poorly understood. In this study, we examined the transcriptional profiles of the microbial community in Lake Taihu, China at 9 stations sampled monthly from June to October in 2014. To target *Microcystis* populations, we collected metatranscriptomic data and mapped reads to the *M.aeruginosa* NIES 843 genome. Our results revealed significant temporal gene expression patterns, with many genes separating into either early or late bloom clusters. About one-third of genes observed from *M.aeruginosa* were differentially expressed between these two clusters. Conductivity and nutrient availability appeared to be the environmental factors most strongly associated with these temporal gene expression shifts. Compared with the early bloom season (June and July), genes involved in N and P transport, energy metabolism, translation, and amino acid biosynthesis were down-regulated during the later season (August to October). In parallel, genes involved in regulatory functions as well as transposases and the production of microcystin and extracellular polysaccharides were up-regulated in the later season. Our observation indicates an eco-physiological shift occurs within the *Microcystis* spp. transcriptome as cells move from the rapid growth of early summer to bloom maintenance in late summer and autumn.

(来源: Environmental science & technology, 2018, doi:10.1021/acs.est.8b01066)

## An Innovative Portable Biosensor System for the Rapid Detection of Freshwater Cyanobacterial Algal Bloom Toxins

Sarah R. Bickman, Katrina Campbell, Christopher Elliott; et al.

Harmful algal blooms in freshwater systems are increasingly common and present threats to drinking water systems, recreational waters, and ecosystems. A highly innovative simple to use, portable biosensor system (MBio) for the rapid and simultaneous detection of multiple cyanobacterial toxins in freshwater is demonstrated. The system utilizes a novel planar waveguide optical sensor that delivers quantitative fluorescent competitive immunoassay results in a disposable cartridge. Data are presented for the world's first duplex microcystin (MC)/cylindrospermopsin (CYN) assay cartridge using a combination of fluorophore-conjugated monoclonal antibodies as detector molecules. The on-cartridge detection limits of 20% inhibitory concentration (IC<sub>20</sub>) was 0.4 µg/L for MC and 0.7 µg/L for CYN. MC assay coverage of eight important MC congeners was demonstrated. Validation using 45 natural lake water samples from Colorado and Lake Erie showed quantitative correlation with commercially available laboratory-based enzyme linked immunosorbent assays. A novel cell lysis module was demonstrated using cyanobacteria cultures. Results show equivalent or better performance than the gold-standard but more tedious 3x freeze-thaw method, with >90% cell lysis for laboratory cultures. The MBio system holds promise as a versatile tool for multiplexed field-based cyanotoxin detection, with future analyte expansion including saxitoxin, anatoxin-a, and marine biotoxins.

(来源: Environ. Sci. Technol., 2018, doi:10.1021/acs.est.8b02769)

## Profound Changes in the Physical Environment of Lake Taihu From 25 Years of Long-Term Observations: Implications for Algal Bloom Outbreaks and Aquatic Macrophyte Loss

Zhang, Yunlin; Qin, Boqiang; Zhu, Guangwei; et al.

The global environment has experienced rapid changes over the past three decades, including global warming, global dimming and brightening, and abnormal climate fluctuations. However, direct evidence of global change in the regional physical environment of a lake is rare especially in China because long-term observations are lacking. Here we demonstrate the profound changes in the physical environment of Lake Taihu using 25 years of long-term meteorological, hydrological, and limnological observations and elucidate the potential implications for algal bloom outbreaks and aquatic macrophyte loss. We document significant increasing rates of 0.36 and 0.37 degrees C/decade for the yearly mean air and water temperatures, respectively. In addition, significant increases are observed for the yearly total sunshine duration and yearly mean water level with the rates of 165.0 hr/decade and 0.15 m/decade. In contrast, significant decreases are documented for the yearly mean wind speed and Secchi disk depth with the rates of 0.27 m/(s . decade) and 0.21 m/decade for the macrophyte-dominated regions, respectively. Therefore, the significant increasing ratio of temperature to wind promoted algal bloom formation and outbreaks, while the decreasing ratio of Secchi disk depth to water level resulted in the loss of aquatic macrophytes, which accelerated the shift from a clear macrophyte-dominated state to a turbid phytoplankton-dominated state in Lake Taihu. Forecasts of increased climatic variability in the future pose serious ramifications for both the ecosystem diversity and service functions of large shallow lakes. Our findings highlight the importance of long-term physical environment monitoring data for understanding ecosystem response to global climate change.

(来源: WATER RESOURCES RESEARCH, 2018, 54(7): 4319-4331)

## Diurnal changes of cyanobacteria blooms in Taihu Lake as derived from GOCI observations

Qi, Lin; Hu, Chuanmin; Visser, Petra M.; et al.

Using frequent and long-term measurements (eight times per day, 2011 to present) from a geostationary satellite sensor (Geostationary Ocean Color Imager, GOCI), this study investigates diurnal changes of cyanobacterium *Microcystis aeruginosa* blooms (near-surface high concentrations or surface scums) in Taihu Lake, from which vertical migration patterns could be inferred. After proper atmospheric correction, a cyanobacterial index algorithm is used to quantify equivalent surface cyanobacterial density (sigma, 0-100%) at both pixel and synoptic scales from each cloud-free image, followed by analysis of diurnal changing patterns of sigma at both scales. Three typical diurnal changing patterns are identified from all images, which show distinctive and different seasonality from the long-term statistics. Spatial distributions of the "hotspot" regions where diurnal changes are most often observed have also been established. While the seasonality of the three patterns appears to be a result of seasonality in both temperature and light availability, large blooms only occur 1 d after major wind events. Based on several lines of evidence, we hypothesize that the diurnal changes of such observed surface bloom patterns are likely a result of vertical migration rather than horizontal dissipation/aggregation of cyanobacteria. The mean migration speeds inferred from either a simple model or a radiative transfer model ( $< 0.03 \text{ cm s}^{-1}$  or  $< 1 \text{ m h}^{-1}$ ) are consistent with those reported earlier from laboratory measurements for certain

cyanobacteria colony sizes. Complete understanding of the three types of diurnal patterns and direct validation of the hypothesis, however, require further investigations from field measurements.

(来源: LIMNOLOGY AND OCEANOGRAPHY, 2018, 63(4): 1711-1726)

## Impacts of hatchery-reared mandarin fish *Siniperca chuatsi* stocking on wild fish community and water quality in a shallow Yangtze lake

Wei Li, Brendan J. Hicks, Mingli Lin; et al.

Mandarin fish *Siniperca chuatsi*, a valuable piscivorous fish, have been stocked into many lakes in China since the 1990s. This study did the first attempt to evaluate the ecological effects of hatchery-reared mandarin fish stocking in the Yangtze River basin lakes. Our study demonstrated a significant change in fish community composition after mandarin fish stocking, but no fish extinction was observed. No significant difference was observed in the total density of 13 forage fish before and after mandarin fish stocking, but the total biomass showed a significant decline after mandarin fish stocking. Significant differences in length-frequency distributions were observed for *Carassius auratus*, *Pseudorasbora parva* and *Toxabramis swinhonis* captured before and after stocking mandarin fish. No significant change in habitat distribution was detected before and after mandarin fish stocking. A marked decline in total nitrogen and a slight decline in total phosphorus were observed while a slight increasing trend for Secchi depth was found after stocking. Our findings suggested that mandarin fish stocking can increase predation pressure on forage fish and subsequently optimize the food web structure. Also, mandarin fish stocking has the potential to improve water quality and may be a feasible strategy to alleviate eutrophication of shallow Yangtze lakes.

(来源: Scientific Reports, 2018, <https://doi.org/10.1038/s41598-018-29758-z>)

## Fish-mediated plankton responses to increased temperature in subtropical aquatic mesocosm ecosystems: Implications for lake management

He, Hu; Jin, Hui; Jeppesen, Erik; et al.

Although it is well established that climate warming can reinforce eutrophication in shallow lakes by altering top-down and bottom-up processes in the food web and biogeochemical cycling, recent studies in temperate zones have also shown that adverse effects of rising temperature are diminished in fishless systems. Whereas the removal of zooplanktivorous fish may be useful in attempts to mitigate eutrophication in temperate shallow lakes, it is uncertain whether similar mitigation might be achieved in warmer climates. We compared the responses of zooplankton and phytoplankton communities to climate warming in the presence and absence of fish (*Aristichthys nobilis*) in a 4-month mesocosm experiment at subtropical temperatures. We hypothesized that 1) fish and phytoplankton would benefit from warming, while zooplankton would suffer in fish-present mesocosms and 2) warming would favor zooplankton growth but reduce phytoplankton biomass in fish-absent mesocosms. Our results showed significant interacting effects of warming and fish presence on both phytoplankton and zooplankton. In mesocosms with fish, biomasses of fish and phytoplankton increased in heated treatments, while biomasses of *Daphnia* and total zooplankton declined. Warming reduced the proportion of large *Daphnia* in total zooplankton biomass, and reduced the zooplankton to phytoplankton biomass ratio, but increased the

ratio of chlorophyll a to total phosphorus, indicating a relaxation of zooplankton grazing pressure on phytoplankton. Meanwhile, warming resulted in a 3-fold increase in TP concentrations in the mesocosms with fish present. The results suggest that climate warming has the potential to boost eutrophication in shallow lakes via both top-down (loss of herbivores) and bottom-up (elevated nutrient) effects. However, in the mesocosms without fish, there was no decline in large *Daphnia* or in total zooplankton biomass, supporting the conclusion that fish predation is the major driver of low large *Daphnia* abundance in warm lakes. In the fishless mesocosms, phytoplankton biomass and nutrient levels were not affected by temperature. Our study suggests that removing fish to mitigate warming effects on eutrophication may be potentially beneficial in subtropical lakes, though the rapid recruitment of fish in such lakes may present a challenge to success in the long-term.

(来源: WATER RESEARCH, 2018, 144: 304-311)

## 科技热点

### “亚洲水塔”失衡导致水患风险加剧

“过去60年来，我们经历了人类历史上前所未有的气候变暖，青藏高原作为世界第三极，是全球气候变化最敏感地区之一，其升温率超过全球同期平均升温率的两倍。”9月5日，在西藏拉萨举办的第二次青藏高原综合科考首期成果报告会上，科考队总队长、中科院青藏高原研究所姚檀栋院士说。

2017年，第二次青藏科考正式启动。有别于“地理大发现”式的第一次青藏科考，这次，扎根青藏高原的科学家们聚焦“变化”，围绕青藏高原地球系统变化及其影响这一关键科学问题，揭示机理，同时为优化青藏高原生态安全屏障体系提出科学方案。

冰川可以储水，高大山体可以拦截水汽，而冰川、冻土、积雪、湖泊、陆地生态系统又可以调节河川径流，因此，青藏高原被称为“亚洲水塔”。“亚洲水塔”失衡，导致水患风险加剧。

“通过遥感和实测资料发现，1976年以来，藏东南冰川退缩幅度平均达到每年40米，有的甚至超过60米。”中科院青藏所研究员徐柏青说。

冰川退缩，相应的是湖泊扩张、河流径流量增加。徐柏青说，青藏高原中部的色林错、纳木错等6个湖泊在1999年以后明显加速扩张。色林错更是于2010年以2349平方公里的面积超过纳木错，成为西藏最大的湖泊。

目前，青藏高原冰川、冻土融化对其湖泊每年增加水量的贡献达26%左右。“而根据我们对纳木错水量变化的定量分析，这一贡献率高达52.9%。”徐柏青说。

“亚洲水塔”正朝着失衡失稳的方向发展。姚檀栋告诉科技日报记者，总体来看，青藏高原东部、南部季风区水储量减少，北部、西部西风带水储量增加。同时，“水塔”固液结构失衡，液态水体储量的增加导致“水塔”结构失稳。

“近期水资源增加，我们感觉到青藏高原的生态好了。但据预测，本世纪中叶冰川对河流径流的补给将达到最大值然后减少，所以长远看，未来水资源短缺的潜在风险在加剧。”徐柏青说，相应的灾害风险也随之而来，例如冰湖溃决、洪水、泥石流等。

（来源：人民日报 2018-09-05）

### 研究揭示青藏高原湖泊是大气温室气体的源

湖泊在全球碳循环中起着重要的作用，尤其是湖泊的沿岸地带更是潜在的温室气体释放的重点区域之一。青藏高原分布着我国最大面积的湖泊群，对当地生态环

境和气候变化具有重要的作用。中国科学院西北生态环境资源研究院（筹）冰冻圈科学国家重点实验室康世昌团队及其合作者对青藏高原 18 个湖泊近岸水体中温室气体（二氧化碳（ $\text{CO}_2$ ）、甲烷（ $\text{CH}_4$ ）和氧化亚氮（ $\text{N}_2\text{O}$ ））的分压及其排放进行了调查分析，发现青藏高原的湖泊是大气温室气体的来源之一。

研究表明，不同湖泊中温室气体的分压有较大差异，尤其是甲烷最显著，这主要是由三种气体不同的产生机制所致。湖泊中  $\text{CO}_2$  的排放主要受可溶性有机碳、可溶性有机氮、盐度和温度的影响； $\text{N}_2\text{O}$  的排放主要受湖水深度的影响； $\text{CH}_4$  由于受到更多环境要素的影响而不存在明显的主控因子，这也是未来需要加深研究的方向。该研究还发现由于青藏高原湖泊主要为咸水湖，具有较高的 pH 值，这种水体特性会加快水气界面的气体交换，从而促使更多的  $\text{CO}_2$  由湖泊向大气释放。该研究为进一步认识青藏高原湖泊在温室气体排放中的作用提供了重要数据，同时也为青藏高原碳循环及其反馈作用的研究奠定了基础。上述工作也是前期关于青藏高原河流温室气体排放研究的一个延续和拓展。

该研究近期在 JGR-Biogeosciences 在线发表，第一作者为博士生严芳萍，合作单位包括中科院青藏高原研究所、青藏高原地球科学卓越创新中心、芬兰拉普兰塔理工大学和美国耶鲁大学等。

（来源：中国科学院网 2018-07-24）

## 未来太湖环保治理的难度进一步增加

据新华社南京9月13日电，记者从中科院南京地理与湖泊研究所获悉，由该所张运林研究员等组成的科研团队，新近对1991至2016年间太湖湖泊生态系统的长期定位观测数据进行了系统研究。研究发现，25年里，太湖湖泊物理环境发生了显著变化：气温、水温和水位显著上升，而风速和透明度则显著下降，这对未来太湖环境治理具有重要指导意义。

此次研究中，科研团队系统分析了1992年以来的25年中，中国生态系统研究网络太湖湖泊生态系统研究站的长期定位观测数据，并揭示出太湖湖泊物理环境的变化过程和潜在的生态效应。研究发现，这25年里太湖水温和水位分别增加了0.93摄氏度和0.38米，风速和透明度则显著下降，其中平均风速和草型湖区透明度分别下降了0.68米每秒和0.4米。由于藻华容易在高温和低风下形成，气温上升和风速降低造成了易发生藻华的气象条件，有利于蓝藻水华生长、漂浮和聚集的藻型生境进一步形成和强化。

而由于沉水植物一般生长在水深较浅、透明度较高的水域，太湖水位的上升以及透明度的下降，致使湖泊底部可利用光显著降低，不利于水生植被特别是生活在湖泊底部的沉水植被获取足够光照进行光合作用。这也致使太湖东南部湖湾湖泊生

境逐步由草型生境向藻型生境转化，驱动湖泊生态系统从“清水草型”向“浊水藻型”生态系统演替，太湖生态系统服务功能出现退化。

张运林说，太湖物理环境的这些变化促进蓝藻生长和漂浮堆积，部分抵消了太湖流域过去10年控源截污对蓝藻水华的控制作用。这也意味着，未来太湖环保治理的难度进一步加大，流域上控源截污需要标准更严、坚持更久，才能产生显著效应。

此次研究得到中科院前沿科学重点项目和国家自然科学基金委创新研究群体等项目的联合资助。相关研究成果已于近日发表在水资源领域权威期刊《水资源研究》上。

(来源：新华网，2018-09-14)

## 纳米二氧化钛污水治理技术暗藏生态风险

中科院合肥物质科学研究院技术生物所许安研究员课题组，以秀丽线虫为模型，在二氧化钛纳米颗粒( $\text{TiO}_2$  NPs)与重金属(镉、砷和镍)联合暴露的生物效应方面取得新进展。相关成果日前被Elsevier旗下期刊《生态病理学与环境安全》接受在线发表。

随着二氧化钛纳米材料的广泛应用，尤其是在污水治理方面，其将不可避免地进入水生态系统，并可与其共存的污染物发生吸附、聚集、沉降以及向生物相的富集等行为。

科研人员发现，二氧化钛纳米材料在水环境中可对三种重金属进行有效吸附并发生团聚作用。二氧化钛纳米材料的快速团聚与沉降改变了重金属在整个水层中的分布，导致游离的重金属离子减少，而底层生物的暴露程度上升。秀丽线虫对不同水层的毒性评价进一步证明了二氧化钛纳米材料(无毒的浓度)与重金属混合暴露一定时间后，可导致上层溶液毒性的降低以及下层溶液毒性的上升。线虫体内重金属的积累水平表现出一致的结果。然而，二氧化钛纳米材料对三价砷As(III)的影响程度却不如对二价金属镉和镍的影响明显，这可能与砷在水环境中特殊的存在价态有关。

研究显示，二氧化钛纳米材料在水环境中的沉降行为，改变了重金属对秀丽线虫的毒性及生物积累水平，颗粒的团聚尺寸与溶液离子强度等都是影响沉降作用的重要因素。

这项研究为二氧化钛纳米材料与环境污染物的联合暴露毒性提供了新证据，同时也说明二氧化钛纳米材料与重金属的相互作用以及共同命运需作为生态风险评估的重要组成部分。

(来源：科技日报，2018-07-11)

## 跨越 200 万年的水文气候记录出炉

在英国《自然》杂志近日发表的一项研究中，法国科学家详细介绍了对过去214万年的非洲东南部水文气候（指水和气候之间的相互作用）的重建工作。研究人员指出，重建过程中发现的气候变化，很有可能对早期古人类的演化产生过影响，并间接导致了粗壮傍人（*Paranthropus robustus*）的灭绝。

水文气候是陆地表面和大气的水分相互作用。人们在和水分循环系统异常所带来的水旱灾害做斗争的过程中，对于水分循环系统自然规律的认识也在不断深化和发展。但是，人们对东非过去200万年的气候变化知之甚少，只知道它或许曾经对人类早期的演化过程产生过影响。至今仅存的长期观测记录，来自于非洲东南部热带地区的马拉维湖，显示该地区在过去130万年里气候逐渐湿润。

此次，法国波尔多大学研究人员辛波尔特·卡雷及其同事，利用取自非洲东南部林波波河河岸的海洋沉积岩芯，和印度洋西南部海面的温度记录，重建了林波波河流域在过去214万年间的天文变化。

研究团队发现，在100万年前到60万年前这段时间里，非洲东南部的气候逐渐变得干旱，与马拉维湖观测记录的变化正好相反。这一发现表明，南极冰山体积不断增加使得当时靠近赤道的雨带范围逐渐缩小。

研究人员推断，长期的干旱化过程很有可能使粗壮傍人偏爱的居住地范围不断缩小，并间接导致粗壮傍人的灭绝。

（来源：科技日报 2018-07-16）

## 多种微生物能分解工业废水致癌物

日本产业技术综合研究所与日本触媒股份公司的研究小组，发现了多种能分解石油化工废水中有害物质1,4-二恶烷的微生物，同时还确认，这些微生物可以通过相互协作维持稳定的分解。

1,4-二恶烷是一种对人类可能有致癌性的有害物质，全球都在加强监管。近年来备受关注的1,4-二恶烷处理方法是低成本、低环境负荷型生物处理。此次，研发小组利用他们开发的不依靠分离培养法的高灵敏度同位素示踪法，从石油化工废水的生物处理槽中发现了多种1,4-二恶烷分解菌，并且它们能通过相互协作来稳定去除1,4-二恶烷。

（来源：日本科学技术振兴机构，科技日报 2018-07-19）

## 火星上发现第一个液态水湖

2018 年7 月25 日, Science 刊发文章《火星上的液态水》(Liquid water on Mars) 称, 意大利科学在火星上首次发现了一个巨大的地下湖, 该湖位于火星一层冰层下, 宽约20 km。这也是迄今火星上发现的最大的液态水体, 这一发现解决了关于火星上是否存在液态水的旷日持久的争论, 增加了火星上存在生命的可能。此前, Science 杂志还发表文章《火星有机质和甲烷的测定》称, “好奇号”火星探测器在盖尔陨坑 (Gale crater) 地表处一块有30 亿年历史的沉积岩中发现了有机分子, 说明火星可能曾存在远古生命。

意大利航天局的研究人员表示, 火星现在是寒冷、贫瘠和干燥的, 但它曾经是温暖和潮湿的。意大利博洛尼亚国家天体物理研究所的研究小组于2012 年5 月至2015 年12 月对位于火星南部冰盖的Planum Australe 地区进行了调查。利用2003 年欧洲航天局发射的火星快车轨道器上的火星高级雷达 (MARSIS) ——用于地下和电离层探测, 通过发送穿透地表和冰帽的雷达脉冲来寻找地下水。结果发现, 共有29 套雷达采样显示“其相关雷达信号发生了非常急剧的变化”, 从而使科学家能够绘制出湖泊的轮廓图。

研究人员表示, 此次发现表明火星上的水是持久的水体, 可以为长寿的生命提供生存条件。如果能够获取水源还可以帮助人类在未来进行地球邻近行星的任务。但是, 这个特殊的湖泊位于冰冷的地表下方近1.6 km 处, 湖水非常寒冷, 与大量溶解的火星盐和矿物质混合在一起, 且由于镁、钙和钠的存在, 温度可能低于纯净水的冰点, 导致极低温度时湖泊仍保持液态。研究人员表示, 目前仍需要其他太空船或仪器进行进一步的证实。

原文来源: <http://science.sciencemag.org/content/early/2018/07/24/science.aau1829>

(来源: 科学研究动态监测快报, 第15期总第285期, 2018-08-01)

## 业界动态

### 全国饮用水源地环保行动发现问题 6426 个

生态环境部 8 月 8 日通报了全国集中式饮用水水源地环境保护专项行动进展,即各地排查县级及以上饮用水水源地 2466 个,发现环境问题 6426 个。水源保护区内存在的主要环境问题包括生活面源污染、工业企业排污、农业面源污染、旅游餐饮污染、交通穿越等项目,分别占问题总数的 27%、16%、16%、14%、13%。

生态环境部表示,各地按照“一个水源地、一套方案、一抓到底”要求,均已建立问题清单管理制度,对排查出来的问题建档立案,为下一步清理整治奠定了较好基础。

据国务院批准的《全国集中式饮用水水源地环境保护专项行动方案》,2018 年底前,长江经济带县级、其他省份地级水源地要完成清理整治任务,共涉及 1586 个水源地的 3991 个环境问题;2019 年底前,所有县级及以上城市水源地要完成清理整治任务。

生态环境部表示,截至目前,全国大部分饮用水水源地均已完成保护区划定,但仍有 109 个饮用水水源地尚未完成保护区划定,严重制约后续工作的开展。这 109 个水源地中,云南和西藏各有 16 个、陕西 14 个、湖北 13 个、四川 10 个,占全国未划定保护区水源地总数的 63%。在推进水源地环境问题清理整治方面,湖南完成比例最高,完成率达 83%;浙江、湖北、吉林和甘肃 4 省工作进展较快,完成率分别是 58%、55%、51%和 46%。但是陕西、山东、广东清理整治相对滞后,部分问题的整治进展为“零”。

据悉,生态环境部组织开展水源地环境保护专项督查,查出环境问题数量前五位是河南、湖北、广东、广西、云南。

(来源:科技日报 2018-08-09)

### 全国 2327 个湖泊设立湖长

近日,水利部部署了 2018 下半年全国河湖整治四大专项行动,旨在压实地方河湖长主体责任,着力解决突出问题,积极改善河湖面貌,增强人民群众的获得感和幸福感。

截至目前,全国已明确省、市、县、乡四级河长 32 万多名,28 个省份将河长体系延伸至村,落实了“最后一公里”的河湖管护责任。纳入第一次全国水利普查名录的 2865 个湖泊,有 2327 个湖泊已设立湖长,其中 18 个省份已完成名录内湖泊湖长的设立。

在抓紧推进建立河长体系的同时,地方各级河长积极巡河履职,组织开展专项

整治行动,依法打击涉河违法违规行为,很多河湖实现了从“没人管”到“有人管”、“管不住”到“管得好”转变,河湖管护成效逐步显现。

水利部要求,各地按照问题导向,因地制宜组织开展有针对性的专项行动。具体如下:

一是开展全国河湖采砂专项整治行动,严厉打击非法采砂行为,清理整治非法堆砂场,维护河湖采砂管理正常秩序。建立以河长制湖长制为核心的采砂管理地方责任体系,严格规划、许可、监管、执法等关键环节的管理,不断健全河湖采砂管理长效机制。同时结合长江河道采砂管理实际,对长江非法采砂整治作出专项部署。

二是开展水库垃圾围坝专项整治行动,作为农村人居环境整治三年行动的一项重要内容,对全国水库进行拉网式排查,彻底治理垃圾围坝问题,促进农村人居环境改善。

三是开展长江干流岸线利用专项整治行动,清理整治河道管理范围内的餐饮趸船、长期“占而不用”的岸线利用项目、违反水法防洪法等法律法规、严重影响防洪安全、生态安全和河势稳定的岸线利用项目。

四是开展长江经济带固体废物专项整治行动,针对大排查行动中发现的河湖管理范围内固体废物,对照点位清单,清理一处、销号一处,2018 年年底前完成集中清理整治。需要鉴别的固体废物,经有关部门鉴别分类后,由地方人民政府提出整改方案,限期整改。对清理整治后的滩地,及时组织开展复绿等生态修复,避免产生新的安全隐患和污染问题。

据悉,各地专项整治行动完成情况,将纳入河长制总结评估和最严格水资源管理制度考核的重要内容。

(来源:人民网,2018-06-22)

## 32 国聚议亚欧水资源一体化管理

9 月 13 日“第三届亚欧城市水管理研讨会”在匈牙利首都布达佩斯召开,会议以“应对全球性挑战的城市解决方案”为主题,旨在形成富有成效的亚欧水资源一体化管理对话机制,推动亚欧各国政府部门、社会组织、企业、学术界间建立通畅共享合作交流平台,推进实现亚欧水可持续发展目标。

此次研讨会由中国外交部、中国科技部、匈牙利外交与贸易部、湖南省人民政府指导,来自 32 个国家的政府官员和专家学者,以及多国驻匈牙利大使和使馆外交官参会。开幕式上,匈牙利总统阿戴尔·亚诺什阁下发来贺信。中国人民政治协商会议湖南省委员会主席李微微致辞表示,湖南高度重视水资源可持续发展,大力实施了污染防治攻坚战三年行动计划,以洞庭湖流域综合治理为重点,深入开展湘江流域污染专项治理,加强落实河长制、湖长制等生态文明体制改革,着力构建人

水和谐的新型城镇化体系。她期待，湖南能依托亚欧水资源研究和利用中心，不断加强亚欧区域交流与合作，提升水科技创新能力，加强宏观层面创新研究与政策对话，探索亚欧水创新合作机制。

会上，来自 17 个国家的 28 位嘉宾，围绕气候变化下的水安全、基础设施开发专业决策与最优解决方案、城市水资源一体化管理、基础设施开发项目最佳实践、城市水资源一体化管理经验、创新与水智慧社会发展等专题作学术报告，分享了城市水资源可持续管理方面的经验和成功做法。

另据悉，来自亚欧区域的 30 多家涉水企业将参加亚欧水安全 B2B 项目对接会。

（来源：科技日报 2018-09-14）

## 24 省水源地环境问题整改任务完成近七成

生态环境部9月24日通报了水源地专项行动第二轮督查进展。在24省今年年底前需完成整治的4276个环境问题中，2827个问题已完成整改，即总体任务已完成三分之二。总体来看，长江经济带县级及以上水源地环境整改任务相对较重，但成效明显。其中，湖南、湖北、浙江等3省的水源地整治任务的完成数量、比例均远超过全国平均水平。

据悉，从2018年9月1日起，生态环境部组织开展了全国集中式饮用水水源地环境保护专项行动第二轮督查，采取全覆盖的方式，对今年年底前需完成整治的1586个饮用水水源地的6251个环境问题逐一开展现场核查，督促地方及时清理水源地环境问题。按照专项行动要求，今年年底前，长江经济带县级及以上、其他省份地市级水源地完成清理整治任务。

从督查情况看，与长江经济带相关的江苏、浙江、安徽8省市完成县级及以上水源地问题整改1536个，完成比例为70%；其他的北京、天津、河北等16省市完成地市级水源地问题整改1291个，完成比例为62%。

生态环境部表示，将持续做好第四批次水源地环境保护专项督查工作，推动问题整改到位，防止反弹等。

（来源：科技日报，2018-09-25）

## 生态环境部：整治黑臭水体不获全胜不收兵

黑臭水体治理是我国污染防治攻坚战标志性重大战役。在7月26日生态环境部举行的7月份例行新闻发布会上，生态环境部水环境管理司司长张波说，2018年度黑臭水体整治专项行动对30个省（区、市）70个城市上报的已完成整治的993个黑臭水体

进行了督查，并把群众是否满意作为首要标准，公众全程参与，滚动管理，不获全胜不收兵。

《水污染防治行动计划》提出：到2020年，地级及以上城市建成区黑臭水体均控制在10%以内。2017年底前实现河面无大面积漂浮物，河岸无垃圾，无违法排污口；2020年底前完成黑臭水体治理目标。直辖市、省会城市、计划单列市建成区于2017年底前基本消除黑臭水体。

张波说，本次督查范围以长江经济带为重点，对70个城市黑臭水体的整治情况进行了督查。通过审核资料、现场检查，对上报已完成整治的993个黑臭水体开展现场核查，评估已完成黑臭水体整治的有919个，占92.5%。

“但是黑臭水体治理的实际情况并非如此乐观。”张波指出，督查还发现了新的黑臭水体274个，这样一来，被督查城市黑臭水体完成比例下降到65.6%。

张波说，发现新的黑臭水体具有偶然性，如前一天刚下了大雨，督查组第二天抵达马上去督查，沿河走时发现一股黑水流出来，于是追踪到新黑臭水体。“还有些城市在我们督查前连续下了多天大雨，问题被掩盖住了”。因此，黑臭水体真正情况可能比公布的要严重，后续还可能会有问题暴露出来。

黑臭水体为何如此难治理？张波说，从督查情况看，黑臭水体治理存在3个主要问题：首先是控源截污不到位。督查期间发现存在控源截污不到位方面的问题共5大类339个，涉及176个水体。控源截污不到位主要体现为存在非法排污口、城镇污水管网不配套、污水处理能力不足、截流的污水未经处理异地排放、雨污合流等方面。另外，督查还发现部分企业存在超排和偷排，把建成区内的污染转移到郊外去。

其次是垃圾收集转运处理处置措施未有效落实。现场督查发现50个黑臭水体河面存在大面积漂浮物，109个黑臭水体河岸存在大量随意堆放的垃圾，部分垃圾堆放点管理较差，垃圾无人清理，垃圾渗滤液随雨水进入河道污染水体。

最后是内源污染未得到有效解决，督查发现25个城市存在内源污染治理问题，有的重污染底泥未得到有效清除，完成整治的河道仍存在大面积翻泥现象；有的清理出的底泥随意堆放，未进行规范化处理处置，极易造成二次污染等。

张波表示，2018年度黑臭水体整治专项行动重点关注控源截污、垃圾清理、清淤疏浚、生态修复等实质性措施的落实情况，结合群众的感官体验、水质监测数据、河面及河岸状况等形式表现，综合评判黑臭水体整治成效。把群众是否满意作为首要标准，专项行动前，群众可通过“城市黑臭水体监管平台”举报疑似黑臭水体；专项行动期间以及行动结束后，群众还可通过“城市黑臭水体监管平台”和公众举报微信公众号反映问题，并对黑臭水体整治工作予以持续关注和监督等。

“督查是滚动管理，不获全胜不收兵。”张波说，专项行动结束后，凡是黑臭现象反弹、群众有意见的，经核实重新列入黑臭水体清单，继续督促整治，直至水体黑臭彻底解决，长治久清。

## 全国水网数据库正式建成: 河流、湖泊、水库有了“身份证号”

日前, 收录了我国333万余条自然和人工河流、湖泊、水库、水渠等水系实体数据的全国水网数据库正式建成。自此, 每条长度500米以上的河流和每个面积大于5000平方米的湖泊、水库、坑塘等都有了自已唯一的“身份证号”, 这将极大地方便今后开展水资源管理、国土空间规划、灾害应急和政府决策等工作, 为自然资源调查监测管理提供基础数据服务。

该项目由自然资源部下属国家基础地理信息中心联合部属陕西测绘地理信息局、黑龙江测绘地理信息局、海南测绘地理信息局和重庆测绘院等多家单位共同完成, 并通过了自然资源部测绘行业管理工作组组织的验收。

据悉, 水体是自然资源调查、监测、管理的空间对象, 赋予其统一的实体代码有利于准确测绘、监测变化和落实监管责任。该项目采集了全国1~9级河流水网数据、集水区单元数据、自然流域分区数据、河流附属设施(堤坝、水闸、排灌泵站)及湖泊库塘数据, 首次对我国第一次地理国情普查中采集到的333万余条自然和人工河流、湖泊、水库、水渠、坑塘等水系实体进行编码, 使全国每条长度500米以上的河流和每个面积大于5000平方米的湖泊、水库、坑塘等都有了自已唯一的“身份证号”, 并理清了汇流关系, 完成了河流分级、流域划分等, 建成了符合1:1万地形图精度要求的全国水网数据库。该数据库支持在水系任一点向上游溯源和向下游追踪及分析, 具有按照名称查询检索全国河流、河段等实体要素的功能。

项目负责人介绍, 过去数据库中的一条条河流、河段都是孤立的弧段, 此次建立的数据库中的每一条河流都是有网络拓扑关系的地理实体对象。例如: 每条河流来自哪里、流向哪里、流经何处都一清二楚; 若产生水污染事件, 其影响范围有多大, 也能快速分析得出结果。

项目实施过程中, 技术人员整合了第一次全国地理国情普查、第一次全国水利普查、国家基础地理信息数据库等多源数据, 先后完成了流域划分方案研究, 河源追溯、主支流自动判别原则和方法研究, 树状水网优化方法研究, 平原地区水网优化方法研究, 自流入海、西部外流区及孤立水系优化方法研究, 人工水系与水网关系研究, 特殊形态河流、湖泊、水系附属物组织方法研究等, 突破了多项关键技术难关, 形成了《水网数据优化处理方案》, 制定了开放式的河流名称及流域编码规范, 用于指导数据生产、实体编码等工作。

(来源: 经济日报 2018-08-28)

## 重大水利工程建设在建投资规模过万亿

7月18日从水利部获悉,截至2018年6月底,172项节水供水重大水利工程已开工129项,其中2018年新开工建设7项;在建重大水利工程投资规模超过10011亿元,提前完成《政府工作报告》提出的“水利在建投资规模达到1万亿元”的目标任务。

2014年5月,国务院常务会议部署加快推进节水供水重大水利工程建设,决定集中力量有序推进一批全局性、战略性节水供水重大水利工程,分步建设纳入规划的172项重大水利工程。

“四年来,172项重大水利工程总体进展顺利,其中18项工程已基本建成并开始发挥效益。”水利部建设与管理司基本建设处处长戚波介绍道,比如南水北调东线一期工程于2013年11月15日正式通水,中线一期工程于2014年12月12日正式通水。

据测算,172项重大水利工程全部建成后,新增总库容约596亿立方米,其中防洪库容约210亿立方米;新增年农业节水能力约260亿立方米;新增年供水能力约821亿立方米。戚波指出,重大水利工程建设不仅整体提升了流域区域水安全保障能力,而且为稳增长、调结构、防风险、惠民生作出了重要贡献。

作为治水兴水的“国之重器”,重大水利工程肩负着提升重要江河防洪保安能力的重任。据介绍,随着江西峡江水利枢纽、松花江干流治理工程、长江流域重要蓄滞洪区建设等骨干防洪工程的陆续建设,我国防洪工程基础设施网络骨架逐步完善,防洪能力进一步提升。

与此同时,重大水利工程建设还加快推进了我国现代节水灌区的发展。随着大型灌区续建配套与节水改造骨干工程、田间高效节水灌溉工程和一批新建大型灌区的相继实施,我国节水灌溉水平大幅提升。据测算,通过172项工程中的大型灌区 and 高效节水灌溉建设项目,可新增灌溉面积约8648万亩,其中仅5个完建项目就发展节水灌溉面积约300万亩。

此外,随着引江济淮等重大引调水工程和青海蓄集峡水库等重点水源工程的建设,城乡供水安全保障能力也大幅提升。据悉,172项工程有一批重大引调水和重点水源工程建设项目,其中仅7个完建项目就新增供水能力约47亿立方米(未含南水北调东中线一期工程)。

“今年以来,节水供水重大水利工程建设取得较快进展,下半年还有珠江三角洲水资源配置工程等一批重大工程将开工建设。”戚波介绍。

(来源:科技日报 2018-07-18)

## 南水北调中线向北方 30 条河流生态补水 8.7 亿方

8月2日从水利部获悉,南水北调中线一期工程日前完成首次正式向北方30条

河流生态补水。从今年 4 月份开始,向沿线受水区河南、河北、天津等省市生态补水,截至 6 月 30 日累计补水 8.7 亿立方米。

利用南水北调中线工程进行生态补水,是水利部贯彻落实习近平总书记“节水优先、空间均衡、系统治理、两手发力”新时期水利工作方针的具体行动和举措。作为国家战略性基础设施,南水北调中线工程在保障京津等华北地区城市供水安全的同时,也发挥了巨大的生态环境效益。

据悉,在河南,中线工程向郑州、南阳、焦作等 12 个城市生态补水,涉及白河、清河、颍河等 18 条河道,补水河湖周围地下水位得到不同程度回升。补水后河湖水量明显增加,水质明显提升。

在河北,此次生态补水共覆盖石家庄、邯郸、保定等 7 个城市,涉及 11 条河道。白洋淀上游干涸 36 年的瀑河水库重现水波荡漾,滏阳河等天然河道得以恢复,部分地区饮水困难得到缓解,一些地区河内污水得到了集中处理。

此外,天津市充分利用南水北调水源,为重要河湖湿地和缺水区域实施生态补水。海河水生态、城市水生态得到明显改善,中心城区环境水质明显好转,各河道水质也得到不同程度的改善。

(来源:科技日报,2018-08-03)

## 全国首条深层污水传输隧道开挖

近日从中铁工程装备集团获悉,该公司自主研发制造的“中铁611号”土压平衡盾构机,已成功应用于武汉大东湖核心区污水传输系统工程施工现场地下34.9米处,全国首条深层污水传输隧道正式开始掘进。

武汉大东湖核心区污水传输系统工程,既是“四水共治”重点工程,也是东湖水环境保护的核心工程。该工程主隧全长17.5公里,跨越武昌区、洪山区、青山区、东湖风景区4个行政区,是目前国内传输流量最大、输送距离最长、首次采用旋流式入流、首次在主城区全部采用全地下式污水预处理站的排污深层隧道,具有“深隧工程国内最长”“施工工艺最全”等特点。

“中铁611号”所在的3#竖井深34.9米,线路全长3.16公里。由于污水深隧系统隧道管径约3米至3.4米,面积只有普通地铁隧道的四分之一,而埋深是地铁的两倍,传统盾构机无用武之地。中铁装备与中建三局依托优势研发团队,突破技术难关,为大东湖深隧“量身定制”小直径盾构机,将18节总长120余米的盾构机拆散,通过管路连接,分布在井下和地面,逐步下井掘进,在地下会合,实现整机掘进。

(来源:科技日报 2018-08-22)

## 第 34 届国际湖沼学大会在宁召开

8 月 20 日, 由国际湖沼学会主办, 中国科学院南京地理与湖泊研究所、中国土壤学会等单位联合承办的第 34 届国际湖沼学大会 (SIL Congress) 在宁开幕。来自全球的 500 多名研究湖泊、河流的专家将共同交流水生态系统保护与修复。据悉, 本届会议是国际湖沼学大会首次在中国举行。

随着人类活动和气候变化等因素的影响, 淡水生态系统受到前所未有的威胁。本届大会主题是“湖沼学——支撑水生态系统保护与修复的科学”。湖沼学作为以水体生态系统为研究对象的交叉学科, 是揭示水体生态系统演变过程与机理的科学, 也是支持水体生态系统管理的科学。国际湖沼学大会, 则是国际上最有影响的内陆水体 (湖泊、河流等) 综合研究的学术大会, 旨在促进内陆水体基础研究和相关应用技术新成果的交流, 内容涵盖生物多样性、富营养化、水质安全、渔业管理与生态系统修复等, 是湖泊、河流等水体研究新成果、新思想与新技术的重要国际交流平台。



本届大会历时 5 天, 涵盖“中国湖泊沉积及全球变化 (PAGES) 的研究”“人工湖: 水坝和水库对全球环境的影响”等大会报告, 以及“全球变化和水生态系统”“水质管理和水生态系统修复”等会议专题。

(来源: 中国科学报, 2018-08-27)

## 青海建成盐湖资源环境信息数据库

在科技部基础专项、中科院百人计划等项目的支持下, 中国科学院青海盐湖研究所历时 6 年建成的中国盐湖资源与环境科学数据库近日正式通过科技部验收, 标志

着我国唯一数据量最大的盐湖资源与环境科学基础数据共享系统正式建成。

中国盐湖资源与环境科学数据库共包含六个专题子库,即盐湖基础信息数据库、盐湖资源数据库、盐湖环境数据库、盐湖资源开发状况数据库、盐湖影像数据库和盐湖多媒体数据库。含有基于野外实地调查和多源数据集成而来的我国近1000个盐湖的基本信息数据、1977年至2013年多期盐湖数量、面积、气象、盐湖分布区landsat卫星影像原始数据、盐湖区表生环境现状、盐湖水量、盐湖类型、盐湖资源种类、盐湖卤水化学数据集、盐湖卤水相化学数据集、盐湖晶间卤水水文地质数据集、盐湖固体盐类资源数据集、盐湖多媒体数据集、2013年盐湖分布区社会经济数据集、高分影像数据集等共十二大类数据,数据量约达570G。

该数据共享平台的建成,为盐湖科学数据的共享提供了基础支撑。未来,数据中心将继续在建设更多专题数据库的基础上,开展盐湖科学全领域多源、异构数据的高效融合及数据应用研究,实现盐湖科学跨域的全面科研协同,并从资源安全及优化配置、综合管理决策、可持续发展等角度,为地方政府、盐湖产业和公众提供盐湖信息资源整合与共享服务,为盐湖资源的合理配置、高效利用的科学决策提供科学依据。

(来源:科技日报 2018-07-13)

## 黄河最大湖泊湿地因非法养殖现状堪忧

乌梁素海是黄河流域最大的湖泊湿地,也是黄河生态安全的“自然之肾”。生态环境部7月3日通报,内蒙古自治区有关部门及巴彦淖尔市工作统筹不力、污染治理进展缓慢,对未批先建的9万亩养殖项目态度暧昧,乌梁素海生态环境形势不容乐观。

乌梁素海生态环境保护对维系我国北方生态安全屏障、保障黄河水质和度汛安全等具有重要作用,也是中央环保督察的重点。中央第二环保督察组对乌梁素海生态环保工作现场督察发现,乌梁素海治理污染项目实施严重滞后,水质总体仍为V类。

农业污染是乌梁素海污染主要来源,2016年自治区政府批复了《乌梁素海综合治理规划》,规划了湖泊生态补水配套工程、湖泊内源污染治理与生态改善工程、规划区污染源减排工程等五大类96个项目,总投资80亿元。但现场督察发现,96个项目中,41项本应于2017年前完成,但截至2018年6月,实际仅完成10项,另有9项在建,22项仍未动工。特别是8个农业面源治理项目、工业园区污水处理及中水回用工程等涉及乌梁素海生态环境治理的重点项目,还未开工建设。

9万亩养殖是从2012年4月引进的河南大湖水产公司项目,但一直未履行环评手续。当地在2017年4月对此罚款97.5万元,并要求对项目开展生态后评估。但

是在没有充分论证和评估情况下，养殖规模不断扩大，2017 年比 2016 年还增加 2 万亩，养殖面积达 9 万亩。

乌梁素海非养殖区域水质清澈、透明性好，而养殖区域水质显混浊。经现场取样监测，非养殖区域水质达到Ⅳ类，而养殖区域水质为Ⅴ类，水质差异明显。督察认为，自治区发改委在审核《乌梁素海综合治理规划》时，对规划目标、任务和措施研究不够、审核不严，致使规划要求与实际工作“两张皮”；在环境整改措施落实时，自治区有关部门各行其是，甚至是敷衍塞责。巴彦淖尔市对 9 万亩养殖项目态度暧昧，对湖区水质影响最大的农业面源污染没有采取实质性措施，说不清、道不明，得过且过。

中央第二环保督察组副组长、生态环境部副部长翟青要求，自治区有关部门和巴彦淖尔市应就规划项目调整、农业面源污染治理、凌汛生态补水、湖区规模养殖、污水收集管网、湿地运行管理、长效机制建设等具体问题明确整改要求，督察组还将做好后续各项督察工作。

（来源：科技日报，2018-07-04）

## 塔里木河流域生态保护与水资源管理研究中心成立

日前从中国科学院新疆生态与地理研究所获悉，由中国科学院新疆生态与地理研究所和塔里木河流域管理局共建的“塔里木河流域生态保护与水资源管理研究中心”近日在库尔勒挂牌成立。

该中心旨在提升塔里木河流域水资源研究与管理水平，加强双方在科研、管理、技术、培训等方面的深度融合，更好地为建设美丽塔河、建设丝绸之路经济带核心区作贡献。中心将就塔里木河流域水资源与生态保护重大科学技术问题、水资源管理制度和水资源优化、高效配置研究，提出流域水生态、水环境、水污染、地下水超采等问题的解决方案，并做好人才交流与培训工作。

（来源：科技日报 2018-08-06）

## 2018 年北京国际水处理展览会举行

9月19日至21日，2018年北京国际水处理展览会举行。展览采用现场互动体验、高新技术演示、产品与新技术发布、海外买家对接等形式，集中展示节能环保领域的最新技术产品和创新解决方案。

图为参展商展示“水资源化全膜法工艺”沙盘。



(来源：科技日报 2018-09-20)

## 福建：9月底前全面实施湖长制

福建省日前印发在湖泊实施湖长制的实施意见，明确在今年9月底前全面实施湖长制，把河流、湖泊、水库、山塘等所有水域都纳入管理范畴，逐个湖泊明确湖长，确保湖区所有水域都有明确的责任主体。

福建将建立健全省、市、县、乡四级河湖长组织体系，省级设总河长2人，负责领导全省河湖长制工作。市、县、乡参照省级模式，逐个湖泊明确湖长，实行网格化管理。已设河长的湖泊，河长更名为湖长；未设河长的湖泊，设立湖长；跨行政区域的湖泊，原则上由上一级党委或政府相关领导担任湖长；小微水体库塘可按片设置湖长。湖泊所在市、县、乡按行政区域分级分区设立湖长，并将湖泊管护纳入河道专管员职责范围，根据实际设置湖泊专管员。

福建将切实摸清全省湖泊基本情况，抓紧编制完善湖泊名录，优化湖泊监测站点，及时划定管护范围，建立“一湖一档一策”，分类指导，因湖施策。将全面推行湖长制工作纳入河长制工作年度考核，考核结果与生态补偿、以奖代补等挂钩。建立激励问责机制，对落实湖长制工作成绩突出的先进集体和个人进行表扬，对落实不力的单位和个人，严格按照有关规定问责追责。加大湖泊保护管理宣传教育力度，运用第三方监管以及借助志愿者、监督员等社会力量加强湖泊管护，激发社会参与热情。

(来源：中国水利报, 2018-09-25)