Editorial: Marine and freshwater quality management

Marine and freshwater are the essential components of the earth’s hydrosphere and their quality management has been one of the most critical and overriding challenges for all the involved researchers, engineers and decision makers around the globe. The availability of the world’s scarce water resources is increasingly limited due to the worsening pollution problems caused by the release of diverse, large quantities of pollutants from point or non-point sources into rivers, lakes, and oceans. Through the food chain, these pollutants can cause acute or chronic effects on the health of aquatic organisms and human beings. Within a global changing context, more effective quality management of marine and freshwater systems demands continuously improved knowledge and technologies, sound decisions and best practices, and benign legal and socio-economic environments to cope with the situation.

This special issue on marine and freshwater quality management contains the selected papers presented during the International Conference on Marine and Freshwater Environments (iMFE2014), which was held in St. John’s, Canada, from August 6 to 8, 2014. The conference was organized jointly by the 2014 Atlantic Symposium of the Canadian Association on Water Quality, the 2014 Annual General Meeting and 50th Anniversary Celebration of the Canadian Society for Civil Engineering Newfoundland and Labrador Section, the 2014 Annual Conference of the International Society for Environmental Information Sciences, and the 2nd International Conference of Coastal Biotechnology of the Chinese Society of Marine Biotechnology and Chinese Academy of Sciences. The areas of scientific interest on which over 110 papers and posters were presented in the conference covered an impressively wide range of topics with significant added-value for scientists, engineers, researchers and policy makers in the field. After a rigorous peer-review process, eight papers have been selected for publication in this special issue, addressing the following topics: (1) environmental modeling, risk assessment and decision making (Sparkes et al. 2016; Rahman et al. 2016); (2) observation and pollution mitigation (Ali et al. 2016); (3) marine oil spill response and countermeasures (Niu et al. 2016); (4) marine resource management and sustainable development (Ding et al. 2016); (5) water and wastewater treatment (Abdelrasoul et al. 2016; Liu et al. 2016); and (6) water safety and public health (Hanrahan et al. 2016). This special issue is devoted to help refine future strategies for effective management of the world’s marine and fresh waters by the summary of recent scientific research on the management of water quality through model- and technology-based investigations and case studies.

Gaining a good understanding of water quality prior to consumption is vital from the perspectives of water supply, usage and management. General models, standardized methodologies, and quality databases and criteria provide a powerful starting point for local water management strategies. These methods allow local managers to benefit from the combined pool of international expertise and research findings, to reduce the need for costly duplication of effort, and to sharpen research and monitoring objectives that will aid local decision-making.

The paper ‘Optimizing water quality sampling through application of real time ionic concentration regression models’ by Rahman et al. (2016) presented an improved regression-based approach to estimate the ionic concentration using continuously measured specific conductance of such commonly measured ions as sodium, chloride, calcium and sulphate. The results indicated that increased variation within grab sample measurements leads to better regressive relationships. The estimated ionic concentrations from the regression models were expected to aid in identifying whether any local stressors were affecting the quality of water at a given point in time, thus making operational decisions in a proactive manner.

The paper ‘Comparison of autoregressive moving average and state space methods for monthly time series modelling of Labrador and South-East Quebec river flows’ by Sparkes et al. (2016) compared two modeling approaches in simulating monthly river flows from basins of different sizes using time series data. Predictions of stream flows for short term planning were made based on these models. It was shown that the state-space-time-series method was
easy to use, but model diagnostics required a high level of statistical understanding. Considering the simple diagnostics and the easy simulation of stream flows, the autoregressive moving average method was suggested to be used for practicing hydrotechnical engineers.

The paper ‘A GIS-based spatiotemporal study of the variability of water quality in the Dubai Creek, UAE’ by Ali et al. (2016) developed an eutrophication model to assess the water quality within the Dubai Creek by using field data from 10 monitoring stations. Ordinary least squares method was used to examine the relationship between chlorophyll-a and nutrients (total nitrogen and phosphate). Multiple logistic regression analysis was used to study the vulnerability of the creek to eutrophication. A high correlation between field and modeled chlorophyll-a values was found. The results showed the probability of occurrence of eutrophication in the bottom half of the creek was greater than in the top half, indicating a higher vulnerability to eutrophication in the bottom. A mitigation plan to reduce the levels of nutrients in the creek was further developed.

The paper ‘Effects of chemical dispersant and seasonal conditions on the fate of spilled oil-modelling of a hypothetical spill near Saint John, NB’ by Niu et al. (2016) presented a numerical study of a hypothetical oil spill with and without the application of dispersant for the selected scenarios of summer and winter, using the Oil Spill Contingency And Response model. The effects of chemical dispersant application on the fate and distribution of oil in different environmental partitions were investigated. An obvious reduction of oil ashore and enhanced biodegradation was observed. However, the increase of oil in the sediment and water column was a concern. The uncertainties associated with environmental inputs (wind and currents) were also examined by employing a stochastic approach.

The growing amount of recalcitrant, toxic organic pollutants carried in wastewater streams or accidently released to marine or freshwater bodies have gained significant attention in water quality management. Their existence poses a key challenge to traditional treatment methods, and demand improved or innovative technologies in order to meet the increasingly stringent water quality regulations at a global scale.

The paper ‘Removal of naphthalene from offshore produced water through immobilized nano-TiO2 aided photo-oxidation’ by Liu et al. (2016) attempted an unconventional approach for nano-scale TiO2 catalyst in removing polycyclic aromatic hydrocarbons (PAHs) in offshore produced water. An ultraviolet irradiation system with suspended and immobilized catalyst and their performance on the degradation of a typical PAH, naphthalene, was evaluated. The adsorption of naphthalene on the surface of TiO2 and the photo-degradation of naphthalene were examined. The results showed that the immobilized catalyst was more resistant to the substrate effects and had a better performance in photo-oxidation. The abundance of aromatic organics was more likely to affect the naphthalene degradation. The adsorption tests indicated that the reduction of catalysts surface area by immobilization was similar to that by agglomeration.

The paper ‘Membrane fouling remediation in ultrafiltration of latex contaminated wastewater’ by Abdelrasoul et al. (2016) studied assessing approaches to reduce the extent of membrane fouling during the filtration of solutions containing latex. Two approaches were utilized, including the alteration of membrane surface charge through the pH change or ionic strength of the latex effluent using anionic surfactant. Hydrophilic polysulfone and ultrafiltric flat membranes and hydrophobic polyvinylidene difluoride membrane were used under a constant flow rate and crossflow mode in ultrafiltration of latex effluent. The effect of linear alkyl benzene sulfonate (LAS) on the ionic strength of the latex effluent and the zeta potential of latex particles at different LAS concentrations was investigated. The results disclosed that increasing the ionic strength of latex effluent was achieved by raising pH. LAS treated membrane surface was much favorable than pH changed feed pre-treatment.

Water quality management strategies must be integrated with safety, health, environmental and social policies. The involvement of local communities has become an essential part of developing and implementing these strategies. Meanwhile, to facilitate more robust management of water quality, sound decision support requires a close link of research- and experience-based knowledge with practices across a broad range of challenges.

The paper ‘Water insecurity in indigenous Canada: a community-based inter-disciplinary approach’ by Hanrahan
et al. (2016) discussed the challenges and issues with respect to water quality and availability in the remote Inuit communities, with particular attention to the Black Tickle community in Labrador, Canada. A case study was conducted to explore and identify the multiple dimensions of water insecurity through a community-based multidisciplinary approach including key informant interviews, focus groups, census, literature review, water testing, and a site visit. It was concluded that water security was chronically and severely compromised and was linked to poverty, food insecurity, and health issues (including mental health) in the study area where there was no piped water and the people relied on an under-funded potable water dispensing unit and unmonitored water sources.

The paper ‘Management of water resources assessment for nuclear power plants in China’ by Ding et al. (2016) reviewed the practices of water resources assessment associated with nuclear power plants in China and then proposed a standard procedure and method for assessing water resources utilization and discharge for both existing power plants and site selection of a new plant. The proposed framework included site survey and data collection, work outlining and approving, water resources assessment, assessment report writing, expert consultation, public participation, technological review, and administrative approval. A case study was provided for illustrating the proposed method. Recommendations were also made, such as carrying out the comparison and selection of optional sites, improving impact assessment of radioactive wastewater discharge, and enhancing public participation.

In summary, the eight papers represent some of the latest and most promising research results in the field of marine and freshwater quality management. We believe that this special issue will inspire further research and benefit practice along the same lines. Finally, we thank all the authors for their worthy contributions and the reviewers for their precious time and efforts to help ensure the high caliber of quality.

**Guest Editors**

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**REFERENCES**


