

Mitacs Project 5 – Determining Water Quality in a Complex Watershed

Background:

This project will provide an opportunity to learn about monitoring a variety of parameters associated with water quality, including nutrients and associated contaminants. It is part of a larger initiative to study ecosystem health in watersheds in China and Canada through monitoring water quality and biodiversity. We have an ongoing collaboration with groups in China working in the Chongming Dongtan Nature Reserve, located on the eastern edge of Chongming Island, the largest island in the Yangtze River Delta. This Reserve, which is mainly a series of wetlands and coastal areas, is designated as a National Nature Reserve in China and a Ramsar Wetland of International Importance (MacKinnon et al. 2012).

Under the UN Sustainable Development Goals (SDGs, United Nations 2015), SDG 6 address “water and sanitation for all”, which features specific targets for drinking water but has equally important targets, such as 6.3, addressing ambient water quality in watersheds, lakes and rivers. These goals are to protect both ecosystem health and human health, which provides the link with other assessments like biodiversity and health of endangered species populations. A number of parameters are monitored as part of water quality assessments in China and Canada. In China, these are captured in the GB3838-2002 regulations (China Ministry of Ecology and Environment 2002; Zhao et al. 2018), where five classes of water are described. In Canada, there are national guidelines for water quality (Government of Canada 2019) that are administered through the provinces.

Objectives:

The student on this project will learn how to make field measurements of key water quality parameters including pH, conductivity, turbidity, dissolved oxygen, nitrogen, phosphorus, and organic carbon. Additional samples will be collected for later laboratory analysis. Field kits for measuring these parameters are available but their use requires specific training to get reliable results (Gałuszka et al. 2015). There will be an initial training period at Queen’s, followed by implementing the methods in the Dongtan Reserve in China. These parameters will be used to assess overall water quality, and will be integrated into results for other studies in this project. Some activity in this project will be integrated with analysis in Project 6 – microbiological quality.

Significance of the work:

The overall assessment of watershed health is critically dependent on knowing the water quality and chemistry. The entire watershed ecosystem is dependent on the health and abundance of organisms starting with microbial species such as bacteria and algae, then extending through the food web all the way to fish and birds that migrate through the area. Noting the trends in water quality over time and across the landscape within Dongtan will provide underlying information for the ecosystem health assessment in general. The student working on this project will also learn about the interactions between water chemistry and the complex biological systems being studied at the same time.

References:

China Ministry of Ecology and Environment (2002) Environmental quality standards for surface water (GB3838-2002). Retrieved from

<http://kjs.mee.gov.cn/hjbhzb/bzwb/shjbh/shjzlbz/200206/W020061027509896672057.pdf>

Gałaszka, A., Migaszewski, Z. M., & Namieśnik, J. (2015). Moving your laboratories to the field—Advantages and limitations of the use of field portable instruments in environmental sample analysis. *Environmental research*, 140, 593-603.

Government of Canada (2019) <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/water-quality/drinking-water/canadian-drinking-water-guidelines.html>

MacKinnon J, Verkuil YI, Murray N (2012) IUCN situation analysis on East and Southeast Asian intertidal habitats, with particular reference to the Yellow Sea (including the Bohai Sea). Occasional Paper of the IUCN Species Survival Commission No.47. IUCN, Gland, Switzerland and Cambridge, UK. ii + 70 pp. <https://portals.iucn.org/library/efiles/documents/SSC-OP-047.pdf>

Zhao, X., Wang, H., Tang, Z., Zhao, T., Qin, N., Li, H., ... & Giesy, J. P. (2018). Amendment of water quality standards in China: viewpoint on strategic considerations. *Environmental Science and Pollution Research*, 25(4), 3078-3092.