

# CHICAGO AREA WATERWAY SYSTEM MICROBIOME RESEARCH



The Chicago River

## RESEARCH STUDY

Scientists from the U.S. Department of Energy's Argonne National Laboratory are partnering with the Metropolitan Water Reclamation District of Greater Chicago (MWRD) in a seven-year study to investigate the typical sources and distribution of microbial communities in the Chicago-area waterway system (CAWS).

Microbial communities are key players in maintaining the CAWS health. Traditional laboratory culture methods such as fecal bacteria counts have been extensively used to characterize the CAWS microbial quality for regulatory purposes; however, these methods are not capable of resolving the source of the contamination. This study, which started in 2013, aims to understand the composition and sources of the CAWS microbial population using state-of-the-art metagenomic science. Metagenomics is the study of the inherent gene make-up of all microorganisms in a

water or sediment sample instead of analysis of a few select indicator bacteria. This novel science method also allows for revealing the common sources of microbial populations and their role in the Chicago river system.

## POTENTIAL SOURCES

There are many potential sources for the microorganisms that can be found in the CAWS. They may come from the treated effluent from wastewater treatment plants, land-based storm water runoff, combined sewer overflows, sediment resuspension, storm drains and from direct input from animals. The study will gain an understanding of the CAWS' microbial communities sources: if they are widespread or free-living; if they are dependant on particular hosts, such as humans, pets, birds; or if particular flow, rainfall, temperature, water chemistry etc., are associated with specific microorganisms. This will help in providing information on how to

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dynamically manage this important water resource and gain insights into the CAWS best management for primary contact recreation uses.

The study will document potential changes in microbial communities as the MWRD begins disinfecting its secondary treated effluents at the O'Brien and Calumet Water Reclamation Plants in 2016 and as phases of the Tunnel and Reservoir Plan (TARP) – the Thornton Composite Reservoir and the first phase of the McCook Reservoir – are completed in 2015 and 2017, respectively. The river water and sediment samples taken in the first three years will serve as a baseline, and more samples will be collected each year until 2019 as the MWRD takes steps to improve the CAWS water quality.

## PROJECT STATUS

Argonne is completing the third year of monitoring, which will conclude in December 2015. This period covered the pre-disinfection baseline with samples collected during low precipitation (dry) and rainy events during the recreational season between March and November each year. Argonne has analyzed samples collected from MWRD's Ambient Water Quality Monitoring stations in 2013, 2014 and 2015, plus several samples of specific identified sources, including fish, pets and seagulls to add to the CAWS microbiome database. This

study is building unprecedented genomic datasets on an urban river system. Researchers have examined the gene make up of cultures isolated by the MWRD as part of its routine fecal coliform bacteria monitoring. Data analysis is ongoing for all samples analyzed to date. Argonne expects the results to be summarized in a draft interim report to be ready early in 2016. The report will be submitted for formal scientific peer review before public distribution.

### INITIAL TRENDS

The results appear to show a difference in microbial communities based on the geographic location of the samples collected. There appears to be more variety of microorganisms in sediment than water samples. Other groups of fresh water microorganisms besides fecal indicator bacteria were found to be abundant in the CAWS. The study also shows apparent seasonal differences which could be attributed to many factors. The information obtained to date should allow researchers to determine whether certain microorganisms are derived from humans or other animals,



Chicago River, looking east toward Lake Michigan

or from the environment at large. Argonne researchers have been focusing on identifying “signature” genes from fish, geese, other birds, pets, sewage and mammals. The study is also exploring the presence, abundance and distribution of a common river bacteria group - Polynucleobacter, and whether it could be used as a marker to assess the ‘CAWS ecological health.

### FOR MORE INFORMATION, CONTACT

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