

Charles Prichard

Supervisors: Dr M.R. Templeton and Dr T. Bond

Department of Civil and Environmental Engineering, Imperial College London

Background to N-DBPs

• **What are nitrogenous disinfection by-products (N-DBPs)?**

N-DBPs are compounds formed during the water disinfection process that were not there prior to treatment.

• **How do they form?**

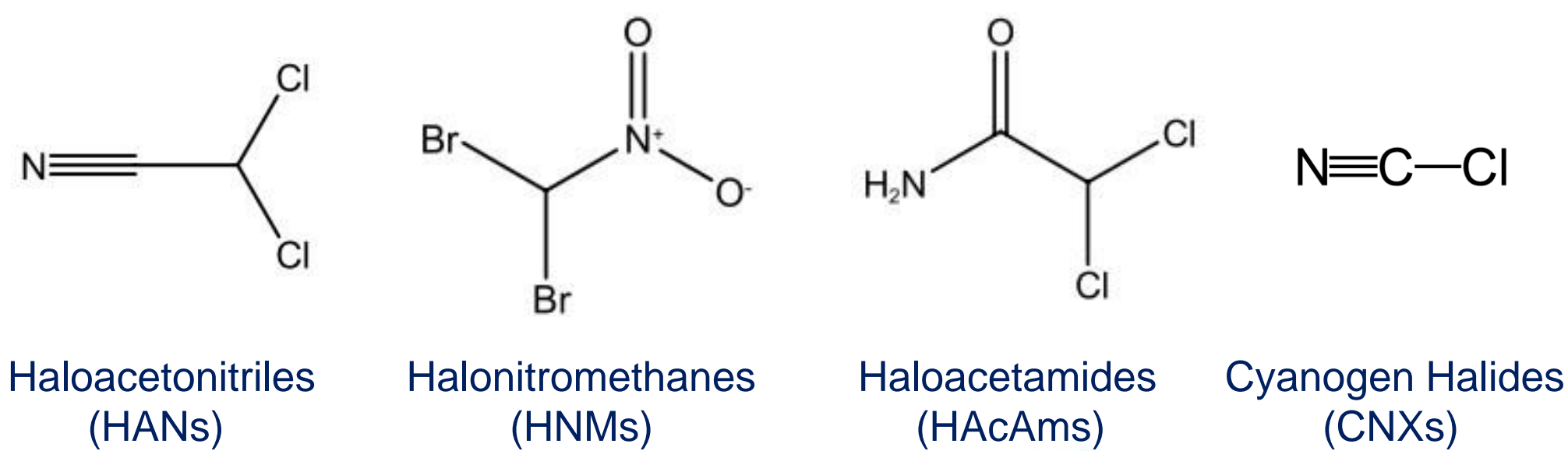
N-DBPs form when the disinfectants used to clean water, such as chlorine, react with naturally occurring organic matter in the source water.

• **Why are they of concern?**

Testing has shown that N-DBPs have diverse toxicological effects in laboratory animals and they may be of higher health concern than some of the currently regulated compounds

• **Which N-DBPs were studied in this project?**

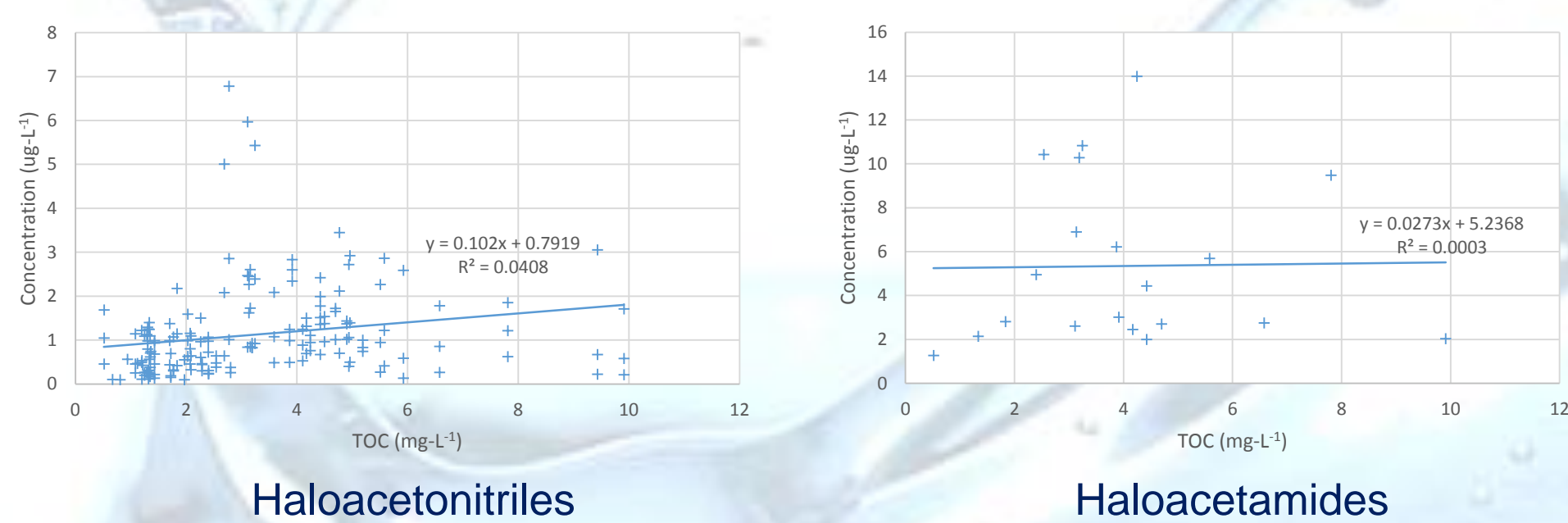
Twenty-two compounds were sampled across twenty water supply systems in England, and they can be split into four groups:



Does the filtered water quality affect the N-DBP concentrations?

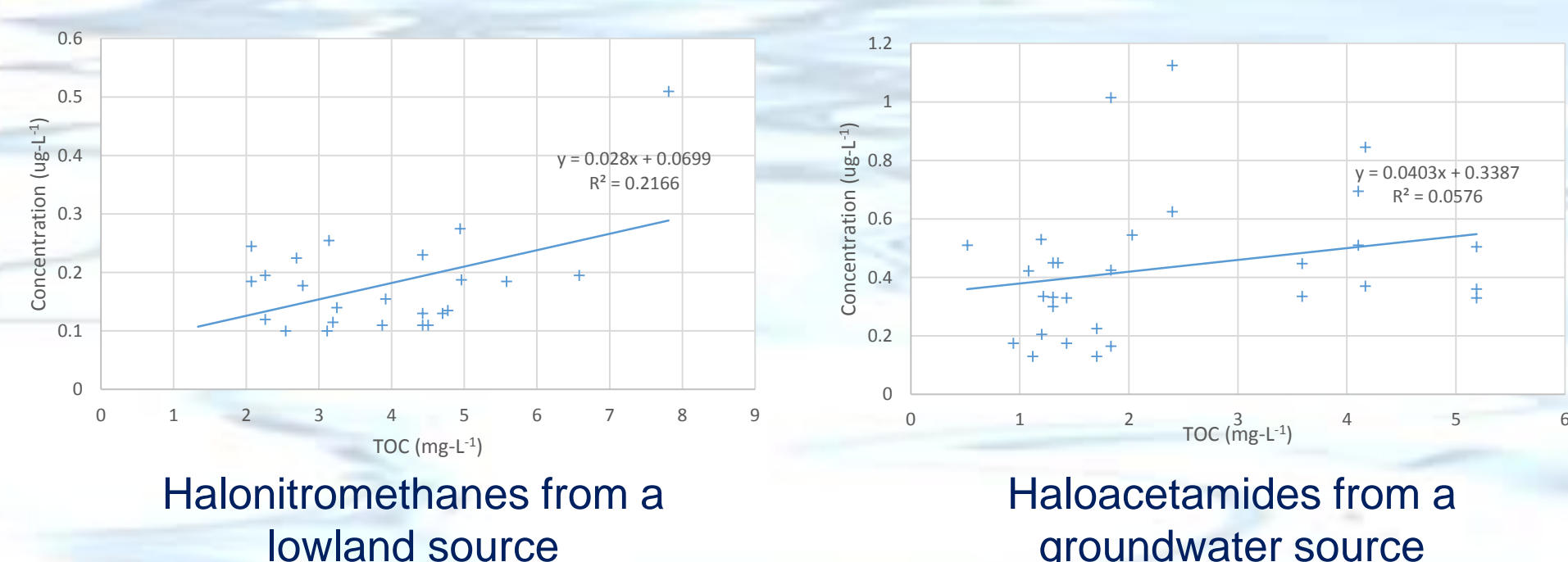
The organic content in water has been proven to be a precursor of disinfection by-products (DBPs), as the carbon compounds form the basis of DBPs. The total organic carbon and UV absorbance of the water (common measures of organic content) had been measured before and after disinfectant treatment.

The following figures show the relationship between the total organic carbon in the pre-disinfection filtered water and the concentration of selected N-DBP groups in the post-disinfection water. As can be seen, the correlation between the two was poor.



The data was then split into three groups: lowland, groundwater and upland. It was expected that the higher organic content in exposed reservoirs would affect the N-DBP production more than other sources.

The figures below show that despite some improved correlations in lowland water sources, there was still not enough evidence to suggest that organic content is a good indicator of higher N-DBP concentrations.



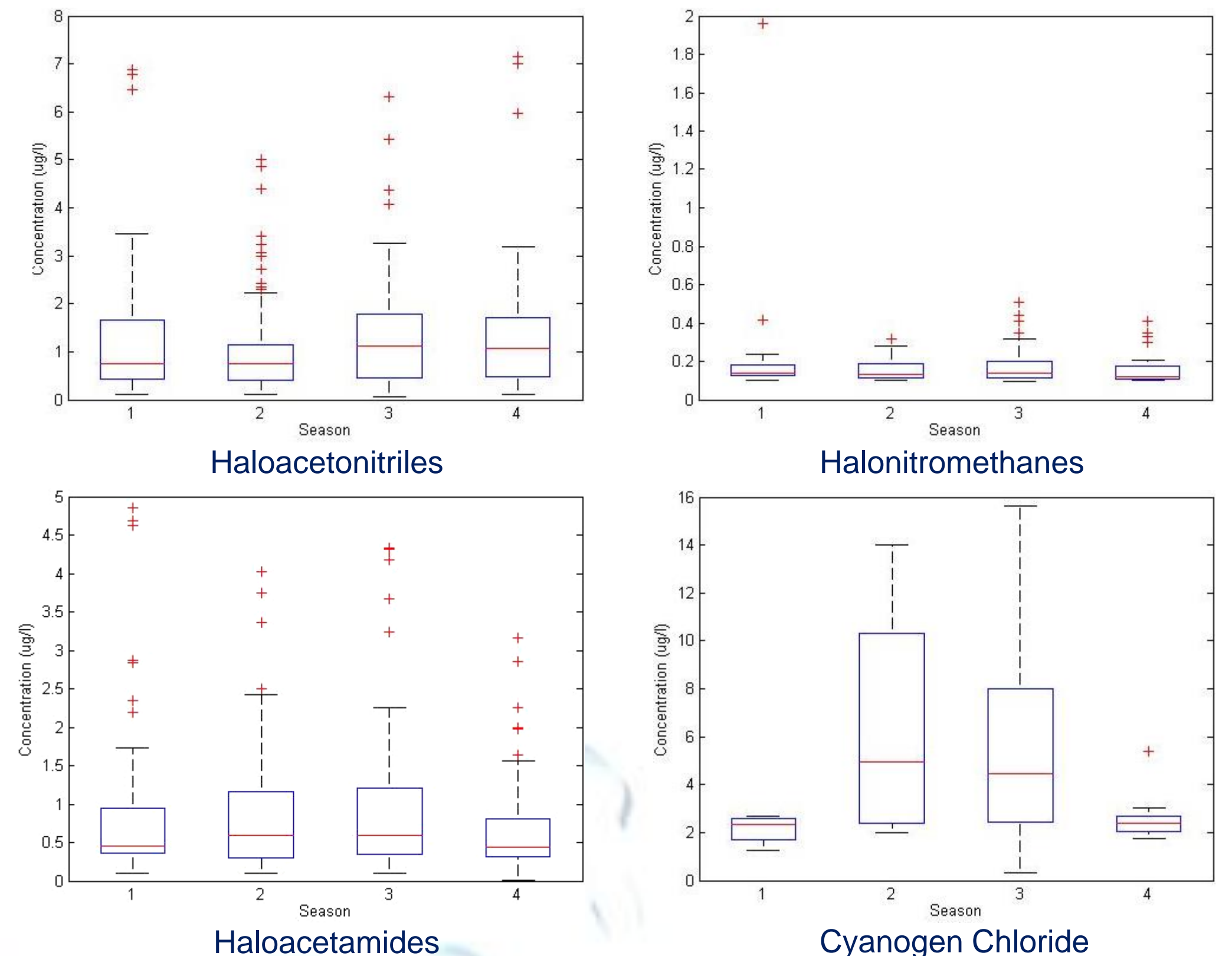
Acknowledgements

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Does the time of year affect N-DBP concentrations?

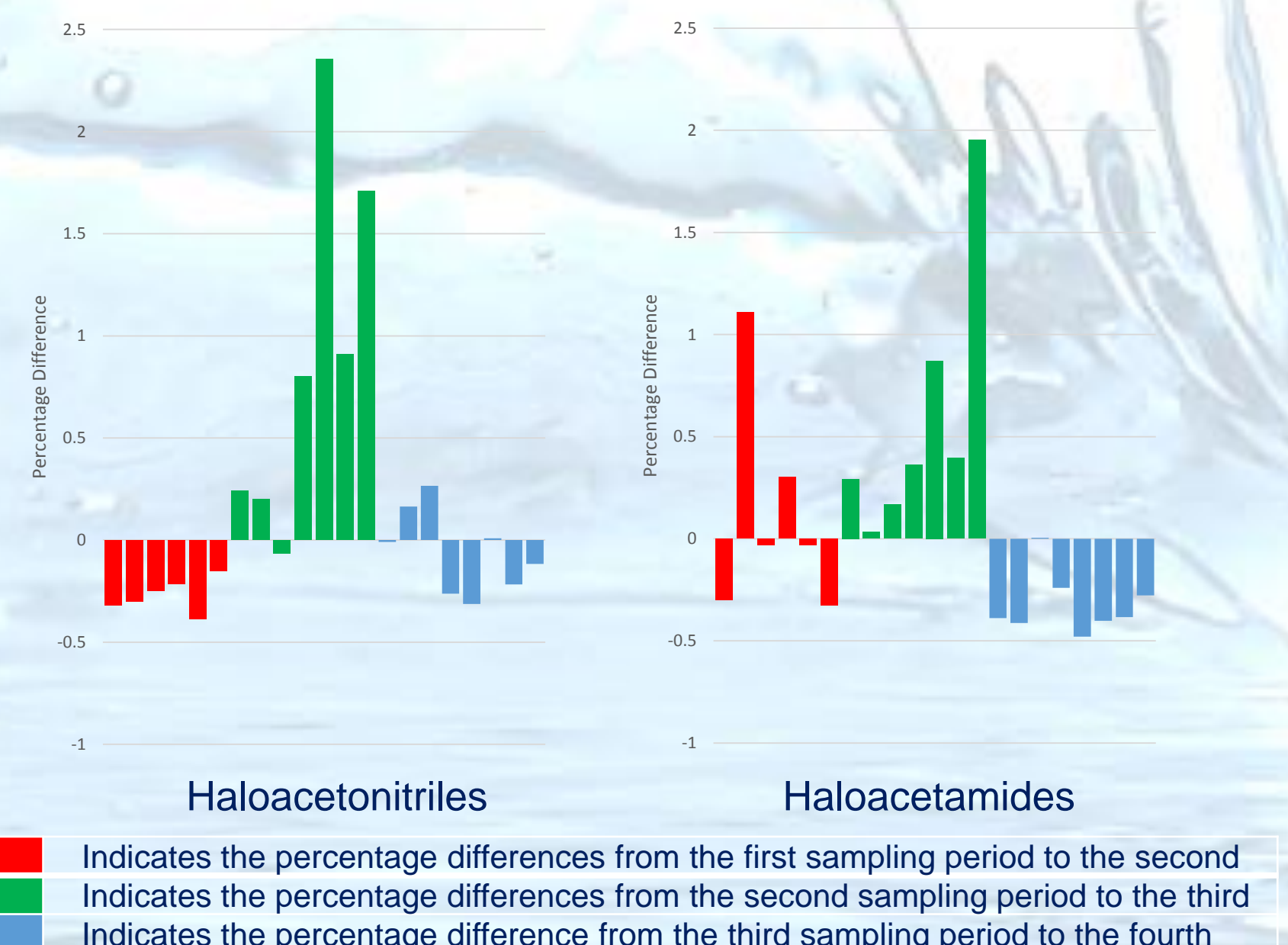
The data was sampled in four rounds: July to Oct 2011, Nov 2011 to Feb 2012, May to July 2012 and Aug to Oct 2012. This allowed for research into how the time of year affects N-DBP production.

The box plots below show how the concentrations of the N-DBP groups varied throughout the sampling periods. The concentrations remain at a similar level throughout the year, except for the cyanogen chloride results. However the cyanogen chloride results have to be viewed with caution due to the relatively low availability of samples.



The problem with grouping the data for each N-DBP group all together is that it is more difficult to identify trends. Therefore bar graphs were created showing the percentage differences of N-DBP concentrations from one sampling period to the next for each source water type. Each of the bars represents the percentage difference value for one treatment plant and its supply system.

The upland and groundwater results were fairly scattered, however some of the lowland results (shown below) indicate that seasonal variation may affect N-DBP concentrations in the treated water from plants drawing their water from a lowland source.



Conclusion

The results suggest that the levels of total organic carbon and UV absorbance in the pre-disinfection filtered water are poor predictors for the concentrations of N-DBPs in the post-disinfection water.

In general, from the data provided, seasonal variation does not appear to have a significant effect on the concentrations of N-DBPs. However, there were indications that lowland water sources were more likely to be affected by the time of year than either groundwater or upland water sources. This may be because lowland waters are more likely to support populations of algae in the summer