Microbiological water quality in rivers of the Scheldt drainage network (Belgium): impact of urban wastewater release

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8th World Wide Workshop for Young Environmental Scientists WWW-YES 2009: Urban waters: resource or risks? (2-5 June 2009)

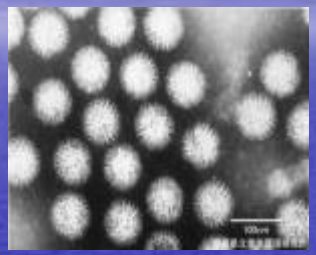
INTRODUCTION

❖Polluted surface waters can contain a large variety of pathogenic micro-organisms

BACTERIA

Vibrio cholerae

VIRUS



Rotavirus

PROTOZOA

Giardia

❖The main origin : The faeces of human and other warm-blooded animals

Human origin

wastewater effluents

Animal origin

surface runoff and soil leaching

The sanitary risk for man linked to the presence of these pathogens

- The use of water
- The pathogens concentration in water

The detection and enumeration of all Pathogens in aquatic sytems are very difficult

⇩

For routine monitoring Indicators of Faecal Contamination (IFC) are usually enumerated to evaluate the level of microbial water contamination.

→ ***Escherichia coli (E. coli)*** **and intestinal enterococci(IE)**

The recent guidelines for assessing the water quality required for different water uses are based on their abundance (2006/7/CE) .

Objective: Evaluate the water quality and understand the dynamic of the microbiological contaminants in the rivers of the Scheldt basin

- A monitoring survey to characterize the level of contamination of the main rivers of the watershed
- Quantification of faecal bacteria sources in the rivers of the watershed
- Laboratory experiments: study the fate of faecal indicators after their release into rivers water

Description of Scheldt Watershed

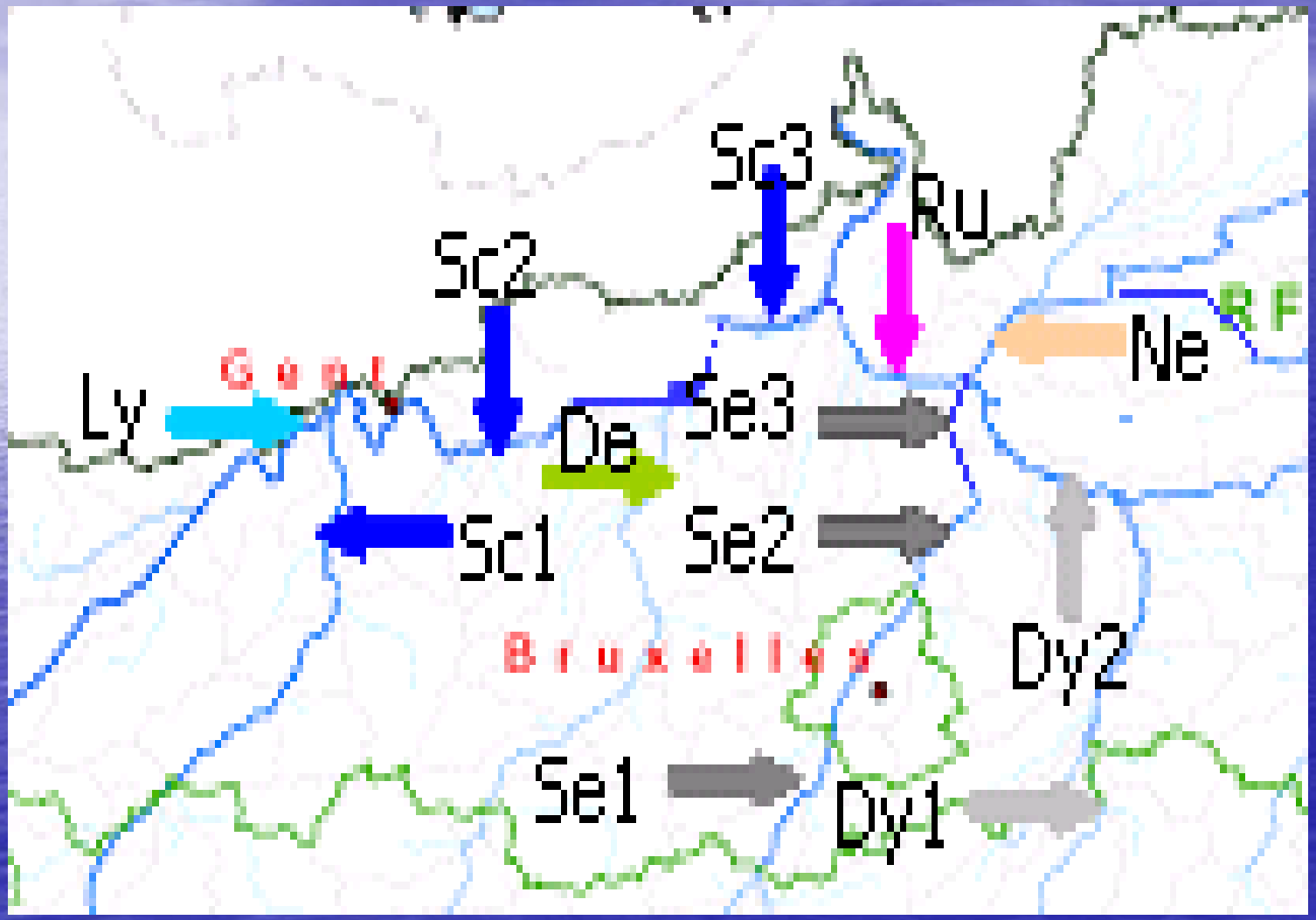
- Area : 21 863 km²
- Population : 11 millions of inhabitants
- High population density (around 500 inhabitants per km²),
- Intense industrial activities and intensive agriculture and animal farming

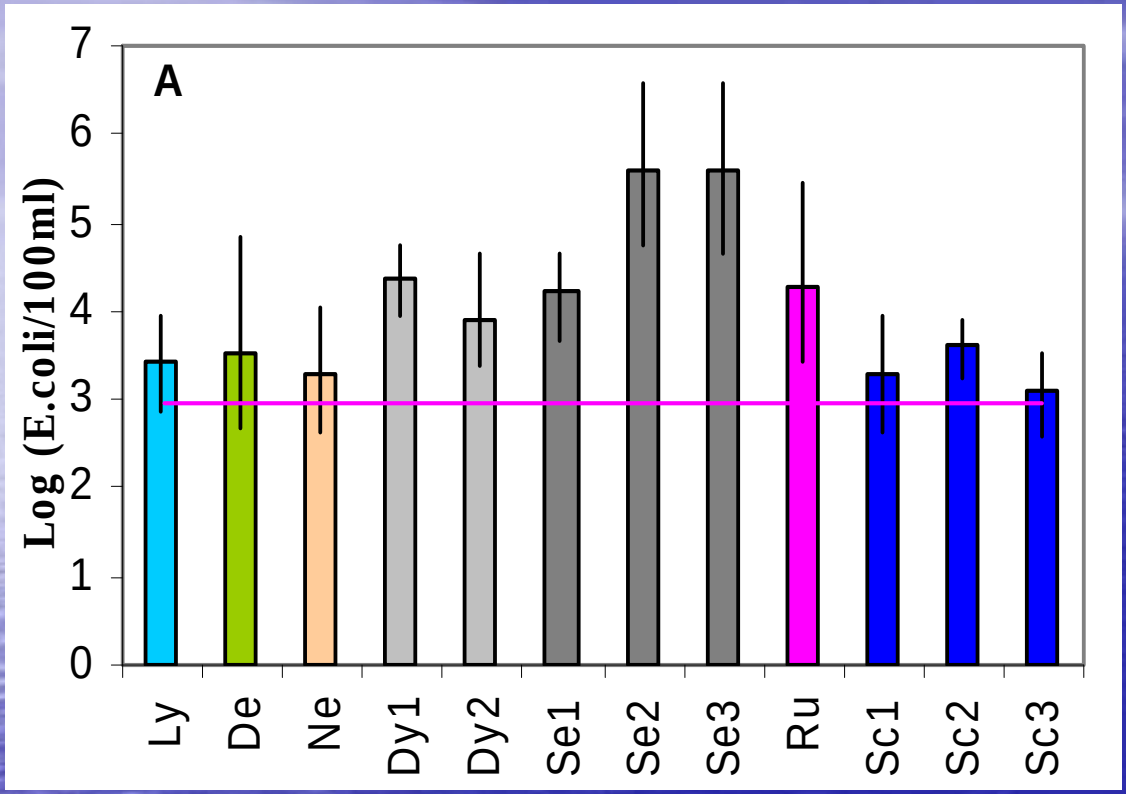
→ Anthropogenic pressures

→ High faecal contamination risk

Results and Discussion

Monitoring results of the level of faecal contamination in the rivers of the Scheldt basin



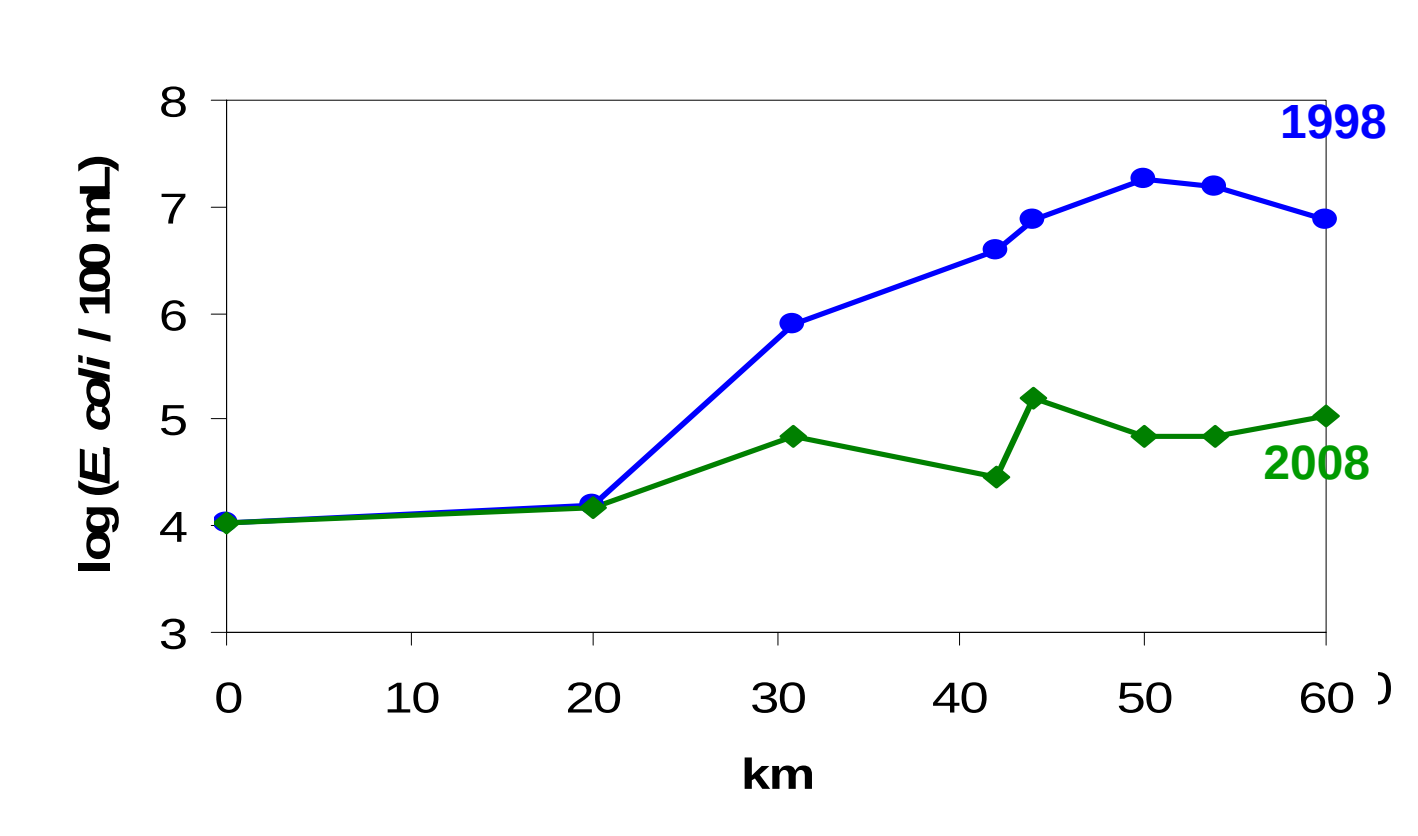


Maximum admissible for bathing water quality (EU, 2006)

- **The main rivers: poor microbiological water quality**
- **The Zenne river : most contaminated**

Longitudinal profile Zenne river

Longitudinal profile of Zenne river

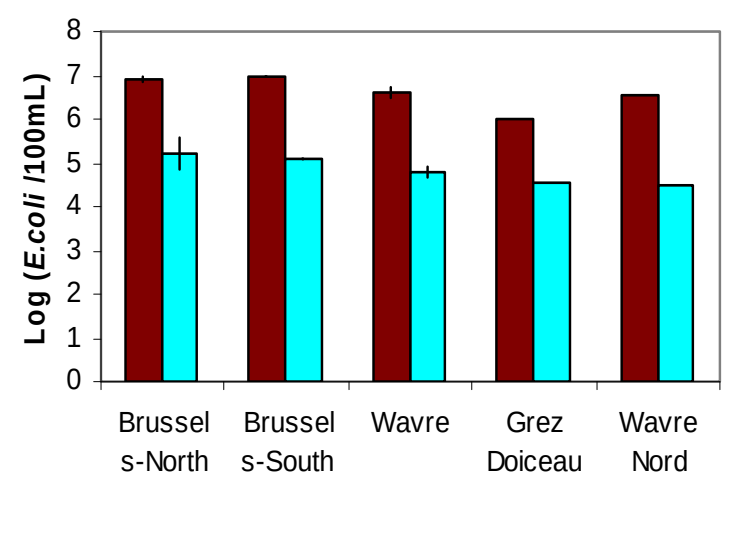


Profiles comparison (1998 and 2008): *E. coli* abundance downstream from Brussels: 2 orders of magnitude higher ten years before

The implementation of the WWTPs of Brussel South (2000) and Brussels North (2007)

Sources of faecal contamination of the rivers (point and non-point sources)

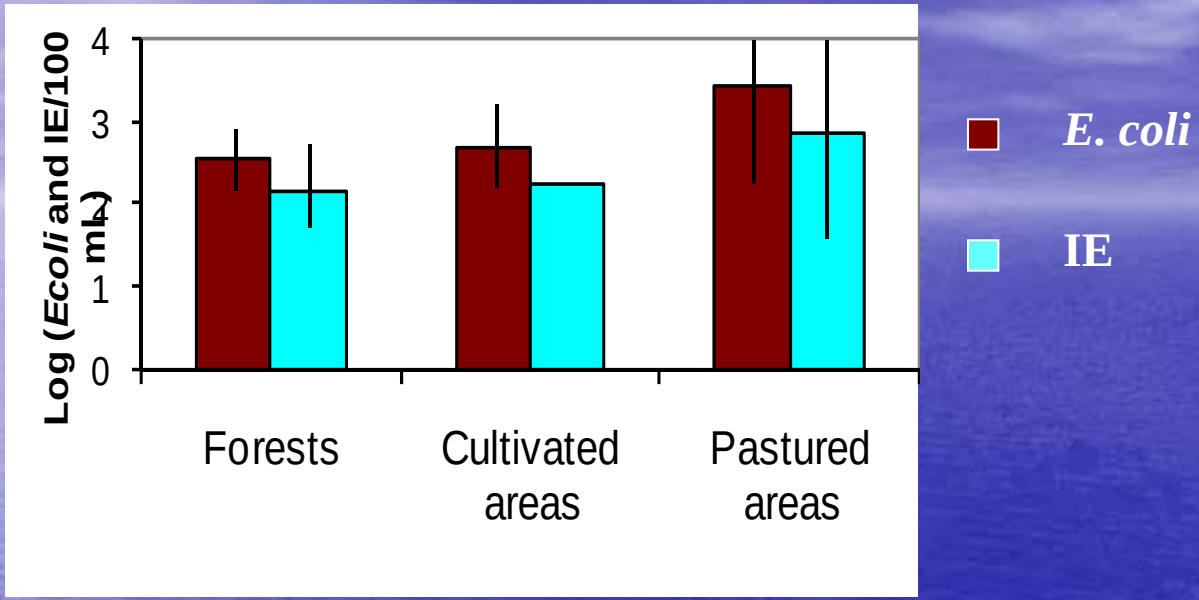
❖ **Point sources (effluent releases)**



➡ **removal rate ranged between 90% and 99%**

Despite this efficient removal, the WWTPs effluents still contain a high abundance of indicator bacteria

❖Non-point sources (surface runoff and soil leaching)



- ✓ The level of faecal contamination dependent on the land use
- ✓ Streams from pastured areas more contaminated

Respective contribution of point and non-point sources

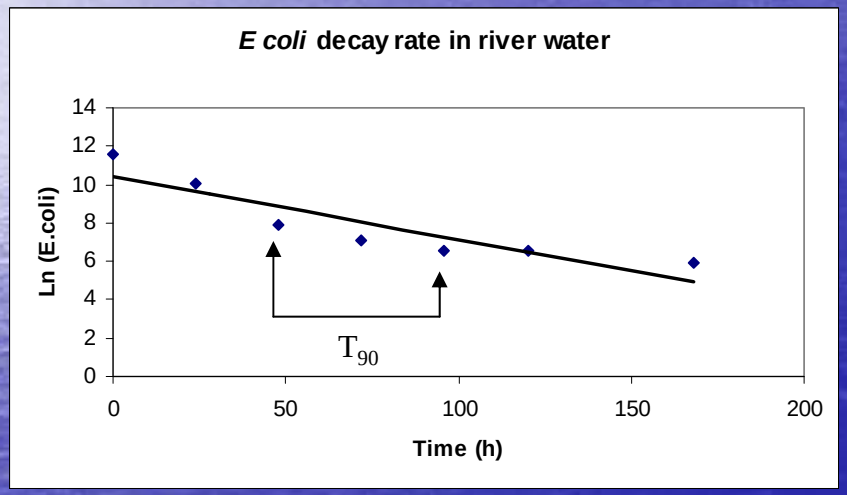
Point sources of faecal bacteria: largely predominant compared to non-point sources

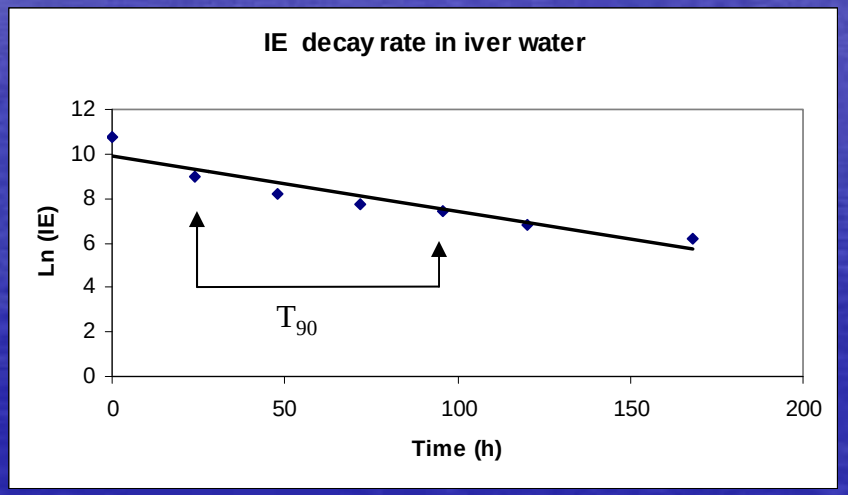
THE FATE OF FAECAL INDICATORS IN AQUATICS SYSTEMS:

Laboratory Experience : Decay rate of *E.coli* and Intestinal enterococci in Zenne water

Slope = first order kinetic (exponential decrease)

(20 °C, In dark)





E. coli : T_{90} = 54h

IE : T_{90} = 72h

The IE are more resistant than *E. coli* in rivers water

CONCLUSION

- **The rivers of the Scheldt basin have a poor microbiological water quality**
- **The Zenne river is particularly contaminated downstream from Brussels**
- **At the scale of the basin, the point sources of faecal bacteria were largely predominant**
- **Batch experiments showed that decay rate of IE in rivers was lower than that of *E. Coli***
- **The final objective of this work is to develop a mathematical model describing the dynamic of *E. coli* and IE in the rivers**

Thanks for your attention