Institute for Hygiene and Public Health
WHO Collaborating Centre for Health Promoting Water Management and Risk Communication

MICROBIAL SURFACE WATER CONTAMINATION RESULTING FROM WASTEWATER AND SURFACE RUN-OFF AND REDUCTIONS IN THE HYGIENIC-MICROBIOLOGICAL CONTAMINATION OF RIVERS

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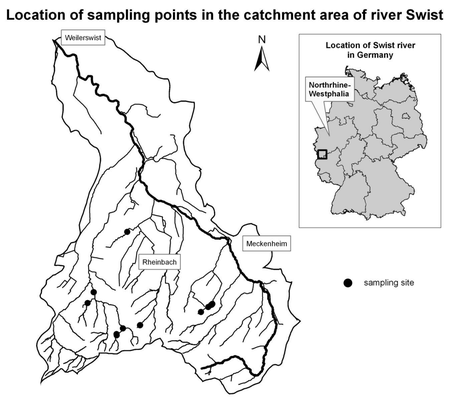
In the context of sustainability and multidisciplinarity, the European Water Framework Directive focused on the water management of whole catchment areas. As there are various relationships between health protection and water protection in terms of synergy effects and conflicts, one has to ask whether the goal of the “good ecological condition” of water bodies is also always sufficient for human health. This can be evaluated by an estimation of microbial water quality,

although no hygienic-microbiological parameter has yet been stipulated in the European water framework directive. During previous projects undertaken at the river Swist (Swist 1-3) in cooperation with the Erftverband, the influence of point sources as well as the pollution by non-point sources has been investigated. The current project, Swist 4 focuses on the mitigation of hygienic-microbiological emissions by three different measures of wastewater and surface run-off treatment.

This investigation focuses on an estimation of the emission potential of different point sources and non-point sources and the verification and validation of different measures of wastewater and surface run-off treatment aimed at the reduction of hygienic-microbiological emissions.



Methods

- Water samples were taken year-round at different sampling sites all over the catchment.
- Samples were analysed for several bacteria using standard methods, e.g. ISO.
- Spatial analysis (ArcGIS®) was used to quantify different land use areas.
- Median microbial concentrations of discharge from sewage treatment plants (STP), combined sewer overflow (CSO) and surface and subsurface run-off from non-sealed areas were used to calculate annual microbial loads.

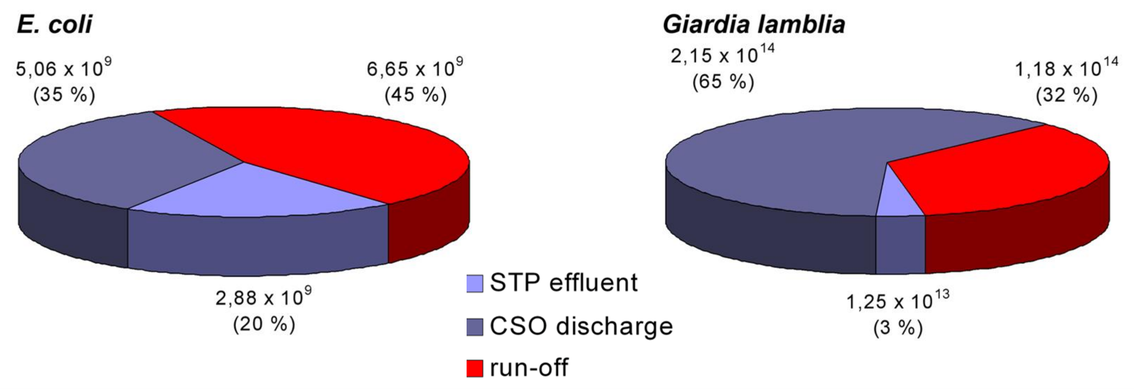


Figure 1: Annual loads of *E. coli* and *Giardia lamblia* in the catchment area resulting from STP, CSO discharge and diffuse run-off

Results and Discussion

- The predominant land use in the catchment area of the Swist is agriculture (Fig. 1).
- Different types of sources have different impacts on the microbial water contamination.
- STP effluents result in a constant background level of water contamination in the Swist catchment area.
- During CSO discharge caused by heavy rainfall events, high bacteria and parasites loads enter the receiving water within a few minutes.
- One CSO discharge can result in bacterial loads as high as the load from a whole day of regular STP effluent.
- Surface run-off contains higher microbial concentrations than subsurface run-off.
- A single land use type that is predestined to cause high concentrations of all microbial parameters could not be identified.
- Depending on the microbial parameter viewed, the impact of diffuse sources on the load varies between 5-74 %, of impact of CSO was 21-88 % and the STP effluent 1-20 % (Fig. 1).

Conclusions

- The management of the catchment area has an important impact on the hygienic and microbiological quality of the water.
- In the catchment of the Swist CSO is a point source of a high proportion of the total annual load and provides optimal conditions for technical-constructional improvements.
- Minimizing diffuse impact seems necessary, but difficult. Adapted cultivation methods in agriculture and natural buffer strips can reduce surface run-off.
- Calculating a point balance is a simple but effective method of microbial risk assessment and the identification of major contamination factors and helpful water management activities facilitate the possible improve microbiological water quality.

Selected References

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