tive investigative monitoring is primarily a national task, at the basin-wide level ICPDR launched the concept of Joint Danube Surveys (JDS), carried out every six years, starting from 2001. One of the specific objectives of the investigative monitoring surveys is to increase the comparability between a homogenous data set produced by a single sampling procedure and laboratory analysis (JDS measurements) and data generated by long-term surveillance type of monitoring (Trans-National Monitoring Network data) carried out by the basin-wide network of TNMN laboratories from each Danubian country.

In a case study carried out in Romania, we intend to provide a comparative view of the surveillance TNMN data and investigative data obtained during the three monitoring programmes known as Joint Danube Surveys 1, 2 and 3, carried out in 2001, 2007 and 2013 respectively. In order to have an optimal way of data comparison and given the survey timing of JDSs (August – September), the momentary results obtained during the three investigative surveys are compared with mean, median and 90-Percentiles of the TNMN data set from August – September during 2001 – 2013.

Microbial Faecal Pollution in the River Danube is Predominantly from Human Sources

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In 2013, the International Commission for the Protection of the Danube River (ICPDR) organized the 3rd Joint Danube Survey to investigate the water quality along the total length of Europe's second longest river. As part of the survey, researchers from the Interuniversity Cooperation Centre Water & Health in Austria (Technische Universität Wien, Medical University Vienna, Karl-Landsteiner-University Krems) and the University of Belgrade, monitored microbial faecal pollution levels by standard faecal indicator bacteria along a 2,580 km stretch of the Danube, as well as in the Danube´s most important tributaries. To track the origin of faecal pollution, host-associated Bacteroidetes genetic faecal marker qPCR (quantitative polymerase chain reaction) assays for different host groups were applied in concert with standard faecal indicator bacteria (SFIB). The spatial resolution analysis was complemented by a time resolution analysis of faecal pollution patterns over one year at three selected sites (downstream the cities of Vienna, Budapest and Belgrade). In this way, a comprehensive faecal pollution map of the total length of the Danube was created, combining substantiated information on both the extent and origin of microbial faecal pollution. Samples were taken midstream of the river and near its right and left banks. Midstream samples representatively depicted the microbial pollution levels at the respective river sites. However, at a few, somewhat unexpected sites (no apparent point sources or larger settlements), high pollution levels occurred in the lateral zones of the river while the midstream zone had good water quality. Using host-associated molecular markers human faecal pollution was demonstrated as the primary pollution source along the whole river, while animal faecal pollution was of minor importance. This study demonstrates that the application of host-associated genetic microbial source tracking markers in combination with the traditional concept of microbial faecal pollution monitoring based on SFIB significantly enhances the knowledge of the extent and origin of microbial faecal pollution patterns in large rivers. It constitutes a powerful tool to guide target-oriented water quality management in large river basins and is a prime example for the value of broad scientific transnational cooperation. For the upcoming Joint Danube Survey in 2019, the research team together with colleagues from the Medical University Graz plan to investigate the link between faecal pollution patterns and the distribution of antibiotic resistance in the Danube.

This mentioned study was recently published in the Journal Water Research:

Kirschner AKT, Reischer GH, Jakwerth S, Savio D, Toth E, Ixenmaier S, Sommer R, Mach RL, Linke R, Eiler A, Kolarevic S, Farnleitner AH (2017) Multiparametric monitoring of microbial faecal pollution reveals the dominance of human contamination along the whole Danube River. Water Research 124: 543–555