

## Abstract

### Problem addressed

The latest European regulations focusing on the integrated management of water resources - i.e., water intended for human consumption, treated wastewater (TWW) for re-introduction into aquatic ecosystems and reuse in agriculture - already adopted (Directive 2020/2184 and Regulation 2020/741) or recently updated (Directive on Urban Wastewater Treatment, 2024/3019), pay increasing attention to understanding the anthropogenic pressures of contaminants of emerging concern, their transformation products (CECs/CEC-TPs) and antimicrobial resistant bacteria and genes (ARB/ARGs) in aquatic ecosystems, as they affect the quality of ecosystem services. Despite the high environmental concern caused by CECs/CEC-TPs and ARB/ARGs, the available data on their occurrence are often incomplete, fragmentary and mostly limited to «target» studies, which necessarily implies a limited ability to assess the risks associated with their presence, hampering the activities of policy makers.

### Strategic objectives

WATERPATH aims to achieve the important and ambitious strategic objective of providing regulators with complete and updated information on the state of CEC/CEC-TP and ARB/ARG contamination in three model geographical areas to support the updating of European environmental policy. WATERPATH also aims to identify strategies to reduce chemical contamination in order to improve the chemical and biological status of water bodies.

### Specific objectives

The strategic objectives mentioned above will be achieved by pursuing the following specific objectives:

- Collect comprehensive chemical data on CECs/CEC-TPs in continental (river water), peninsular (river and groundwater) and island (marine water) ecosystems using advanced analytical techniques.
- Integrate qualitative chemical data with «two-way» quantification of CECs through (a) retrospective non-targeted analysis (NTA) and (b) workflows for targeted analysis of specific CECs/CEC-TPs.
- Perform a risk analysis using the risk quotient index for the quantified CECs/CEC-TPs.
- Collect comprehensive and quantitative data on the above ecosystem services of ARB/ARGs through metagenomics and targeted cultivation for meta-analysis.
- Identify biomarkers that can be used to assess mitigation processes.
- Integrate the chemical and biological qualitative-quantitative data obtained with site records of drinking, surface, ground and marine waters available from national monitoring authorities and scientific literature to obtain spatial and temporal trends of CEC/CEC-TP and ARB/ARG contamination.
- Meta-analysis of chemical and biological data obtained through NTA and targeted workflows, integrated with appropriate qualitative descriptors, to identify effective indices for assessing the anthropic pressure exerted by the presence of CECs/CEC-TPs and ARB/ARGs on the ecosystems under study, following a «one health» approach.
- Evaluate low- and high-tech mitigation strategies as potentially suitable approaches to restore chemical and biological ecosystem quality.



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- UNIVERSITY OF LAS PALMAS DE GRAN CANARIA - SPAIN
- BABEȘ-BOLYAI UNIVERSITY - ROMANIA
- G.I.D.A. SPA - ITALY
- AGENZIA REGIONALE PER LA PROTEZIONE AMBIENTALE DELLA TOSCANA - ITALY

### ► Funding organisations

MUR (ITALY) / AEI (SPAIN) / UEFISCDI (ROMANIA)

### ► Duration

3 years

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contaminants of emerging concern  
antimicrobial resistant bacteria/genes  
non-target and target analysis  
internal and marine waters  
environmental and human health risk analysis

## KEYWORDS