



## Webinar Summary Report

*EurAqua Webinar*

*Human Health and Water in a Changing Environment*

*Developing a European Response to Pandemics*

*(including Covid 19)*

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**Monday 7<sup>th</sup> December 2020**  
**(10.30hrs – 12.30hrs CET)**

*Organizer: Dr Alan Gilmer*  
*TU Dublin*



*EurAqua Webinar*

*Human Health and Water in a Changing Environment*

*Developing a European Response to Pandemics*

*(including Covid 19)*

**Webinar Summary Report**

EurAqua - the European Network of Freshwater Research  
Organisations

Alan Gilmer  
*(TU Dublin)*



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The views expressed in this Webinar Summary Report are those of the author and the presenters and do not necessarily reflect the policies or opinions of the EurAqua – The European Network of Freshwater Research Organisations or its member organisations.

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## Acronyms

|          |                                                                                                                                  |
|----------|----------------------------------------------------------------------------------------------------------------------------------|
| CDP      | Carbon Disclosure Project                                                                                                        |
| CSR      | Corporate Social Responsibility                                                                                                  |
| DHA      | Docosahexaenoic Acid                                                                                                             |
| EEA      | European Economic Area                                                                                                           |
| EU       | European Union                                                                                                                   |
| EPA      | Eicosapentaenoic Acid                                                                                                            |
| FA       | Fatty Acids                                                                                                                      |
| GHG      | Greenhouse gas                                                                                                                   |
| IRSA-CNR | Istituto di Ricerca sulle Acque - Consiglio Nazionale delle Ricerche<br>(Water Research Institute-The National Research Council) |
| JPI      | Joint Programme Initiative                                                                                                       |
| MoU      | Memorandum of Understanding                                                                                                      |
| PCR      | Polymerase Chain Reaction                                                                                                        |
| Q&A      | Questions and Answers                                                                                                            |
| RDI      | Research Development and Innovation                                                                                              |
| RNA      | Ribonucleic Acid                                                                                                                 |
| SARS     | Severe Acute Respiratory Syndrome                                                                                                |
| SYKE     | Finnish Environmental Institute                                                                                                  |
| WFD      | Water Framework Directive                                                                                                        |
| WW       | Waste Waters                                                                                                                     |

## Introduction

This Webinar was set within the framework of EurAqua's vision and mission as the European Network of Freshwater Research Organisations. The Webinar sought to address key topics in research and innovation that are leading the way in advancing our understanding of the interactions and impacts at the water-health-climate nexus within the European Water Management sector particularly in terms of pandemics and Covid 19. The Webinar brought together key speakers and contributions that demonstrate the relevance of current research in the face of global challenges linking health and water in a changing environment. It also provided an opportunity to promote collaboration and multidisciplinary in the development of novel approaches and cutting edge research within the context of Horizon Europe, the Green Deal and the JPI Water 4 All partnership initiative. The general approach of the Webinar was to promote an open exchange of information, ideas, knowledge, practice and know-how in water management, natural water system dynamics, water investment and infrastructure and water quality control, all within the context of human health (including pandemics and Covid 19).

The webinar was structured with an introduction followed by five presentations, each accompanied by a Q&A session and then finally a summative discussion of the presentations and a chat-based feedback collection from all participants. This report presents a summary of the presentations and evaluates the discussion and feedback from participants collected through the Q&A input and the chat box feedback within the overarching context of the Webinar.

## Overview of EurAqua

### **EurAqua - the European Network of Freshwater Research Organisations 25 years of Research and Competence at the service of European Freshwater Management**

*Anna-Stiina Heiskanen (Chair of EurAqua)*

The mission of EurAqua is to contribute to the development of European freshwater science and technology as well as to its dissemination on a European scale. EurAqua's actions therefore aim to play a significant role in the development of the scientific and economic basis for European water management. This process is centred around a number of core actions including science-policy and research strategy development, joint scientific programmes and close collaboration with other networks and initiatives. EurAqua consists of 26 partner organisation and centres of freshwater research across the European Union and EEA. The partner institutions tend to be key advisors to the 'water management' Ministries and other regional water authorities as well as having a strong international profile and close links to the water management industry. EurAqua has been involved in a wide range of high profile research and policy development initiatives including, the identification and validation of RDI needs (e.g. Water 4All); the writing of position papers and responses to open consultations (e.g. H2020 and Horizon Europe); meeting with members of the European Parliament in the

identification of collaboration opportunities; the formalization of MoUs with other key water / environmental organisations (e.g. Partnership for European Environmental Research (PEER) and Water Europe (former WssTP)); and through playing a key role as observer on the WFD Strategic Coordination Group and the JPI Water Stakeholder Advisory Board as well as participating in the EU Water Alliance. EurAqua's strategic research and innovation agenda is centred around three main themes: (i) Environmental quality and human well-being under climate change, including system understanding and monitoring, restoration measures, management and governance; (ii) Climate change and natural hazards, including floods, droughts and water scarcity; and (iii) Cross-cutting issues such as digital technologies and big data. EurAqua and its membership recognise the close relationship between water and human welfare. Indeed, our natural and built environment, our values as a society and our systems of regulation and governance all impinge on the quality and availability of water for our societies. Hence, managing this cross over, at the water-environment-health nexus is crucial for optimising health and social equity, economic prosperity and societal wellbeing. Today's webinar reflects this imperative and seeks to shed some light on the latest developments in allied fields of research and practice and so foster the potential for knowledge exchange, creative thinking, the emergence of cross cutting themes and the development of novel approaches to new and emerging challenges in water, environment and health.

## Presentations

### 1. **SARS-CoV-2 in wastewaters and rivers: the IRSA-CNR experience in one of the most affected area, the Milano Metropolitan Area (Italy)**

*Presented by: Fabrizio Stefani, IRSA-CNR, Brugherio, Milano.*

The presence of SARS-CoV-2 in wastewaters (WWs) has been demonstrated in many countries affected by the pandemic. However, there is limited understanding of the infection potential of the virus in treated wastewaters and receiving water bodies. In this study, raw and treated water samples from three wastewater treatment plants, and three river samples within the Milano Metropolitan Area, Italy, were surveyed for SARS-CoV-2 RNA detection by means of Real-time PCR (RT-PCR) and infectivity tests on cultured cells. The SARS-CoV-2 RNA was detected in raw, but not in treated wastewaters. The presence of RNA in raw wastewater samples was seen to decrease after eight days. There was no indication of viral infectivity which is consistent with the natural decay of viral pathogenicity over time. Some samples from receiving rivers (three sites, sampled at the same time as the wastewaters) showed a positive response using RT-PCR, probably due to non-treated, or inefficiently treated discharges, or to the combined sewage overflows. Nevertheless, in terms of rivers infectivity was null. It was estimated that there should be little or no risks to public health, although a precautionary approach to risk assessment is advocated, giving the preliminary nature of the available data.

### **Monitoring SARS-CoV-2 in water: gaps and opportunities**

- SARS-CoV-2 RNA is now commonly detected in raw WWs in a wide number of cases (e.g. Netherlands, Australia, US, China, France, Israel, Italy, Spain, Turkey, India, Japan). Efforts are now concentrating on building accurate *early warning* tools to support the epidemic control. More sensitive approaches are still needed (e.g. digital PCR, analysis of sludges).
- A relatively small number of studies investigated the presence of SARS-CoV-2 RNA in WWs after treatments (Spain, Turkey).
- Virus infectivity in WWs was investigated in a few studies. However, infective virus was found in faeces and transmission of virus via aerosol suspected in one case (Wang et al., 2020; Wei et al., 2020).
- A single other study has looked for SARS-CoV-2 RNA in final receptors of WW treatment plants in Japan (Haramoto et al., 2020), and the authors did not find any detectable RNA amplification (in that case, the prevalence was lower than in the Milan area).

### **Q & A with Alan Gilmer**

*Because of time constraints a single question was presented reflecting several inputs*

**Question:** Are there other promising approaches to detect and quantify SARS-CoV-2 in wastewaters and in surficial waters, which could be tested?

**Answer:** This was a preliminary study to provide information on the general behaviour of SARS-CoV-2 in wastewaters and receiving freshwater systems. It also provided an opportunity to gather the inputs of other researchers working in this space and to evaluate the general assessment methodologies being considered, including biosensors and biomarkers of exposure such as those associated with inflammatory responses. Digital PCR could be employed in the near future as it has a detection resolution that is ten times greater than that typically experienced with Real-Time PCR. Additionally, a range of user friendly devices are also being developed e.g. paper based microfluidic devices that can be used by the non-expert in detection analysis. This is a dynamic and evolving area and the current high demand for new ways to tackle the challenges of the SARS-CoV-2 outbreak will greatly advance development and adaptation of new technologies.

## **2. Insights from corporate disclosure on water and wastewater management.**

*Presented by: Fraser O'Halloran, CDP (Disclosure Insights Action) Europe, London.*

The CDP mission is to focus investors, companies and cities on taking urgent action to build a truly sustainable economy by measuring and understanding their environmental impact. In particular the strategy identifies four main pillars including (i) the inclusion of the global non-profit sector; (ii) developing and operating disclosure systems for environmental impacts; (iii) aiming to represent the gold standard in terms of environmental reporting; and (iv) optimizing

network use for data sharing and better and more informed decision making. Driving this strategy forward CDP provides data and insights on impacts, risks, opportunities, investments and strategies back to investors & purchasers in promoting trust and transparency.

In 2020 a survey of 5,537 high impact companies was undertaken which asked them to provide water related data via CDP. Of the companies contacted some 2,934 responded and the data provided has helped to shape our general understanding on how the corporate sector has been responding to the challenges of the Covid 19 pandemic particularly in terms of their effectiveness in developing and operating safety protocols. It is evident that awareness of wash-related risks is low, with 40% of the companies including access to fully functioning wash facilities within their water-related risk assessments. Only 1% of companies consider inadequate access to wash through their value chain as being a substantive risk to business. A further 7% of companies have set targets or goals to improve access to wash services throughout their value chain. There is some evidence that companies may be blind to the risks of pollution with only 12% of the companies surveyed reporting pollution risks and a similar proportion setting pollution reduction targets in 2020.

In conclusion it is recognised that;

- Corporate action both to improve access to WASH services, and help protect, restore and improve the management of the world's water resources can make a meaningful difference in reducing pandemic risk;
- Poor water stewardship is pervasive and is undermining global health and prosperity. CDP's data suggests, in general, companies worldwide are not doing enough to improve access to WASH or tackle water pollution;
- Transparency and reporting is the bedrock of effective water stewardship and in driving lasting, transformational change. This has never been more important.

### **Q & A with Alan Gilmer**

*Because of time constraints a single question was presented reflecting several inputs*

**Question:** Which sector do you see as having the largest potential to drive improvements in the provision of WASH facilities and in the reduction of water pollution globally?

**Answer:** The textiles and apparel industry generates a significant quantity of pollutants and has a significant impact on water quality generally. CDP through the collation of data and the enhancement of transparency in reporting has made considerable strides in promoting water stewardship in the apparel and textile sector (among others). This has helped the industry to respond positively to the challenges of water quality and the development and operation of wash facilities. One of the key processes that can help in the current context of water quality and the Covid 19 pandemic is wider engagement of wash facilities integrated into the product value chain from manufacturing through to product use. Across many sectors improvements have been made in terms of corporate social and environmental responsibility and this has a direct benefit in supporting more sustainable and responsible practices in water management, with obvious implications for Covid 19. Additionally, the availability of this type of environmental performance data helps to enhance certainty and limit risk for investors and other stakeholders in supporting the development of industries.

### 3. Impact of browning on aquatic food webs and ultimately on human health

*Presented by: Kristiina Vuorio, Finnish Environment Institute (SYKE), Helsinki.*

About 85% of Finnish lakes and about 65% of rivers are in excellent or good ecological state. The status is moderate or poor, mainly in agricultural areas. The large proportion of forests and peatlands has caused browning of waters in the catchment. Both eutrophication and browning affect the composition of phytoplankton communities. As a result of eutrophication, the proportion of cyanobacteria increases and due to browning the proportion of the slimy alga *Gonyostomum semen* increases and the proportion of golden algae decreases. In Finnish lakes, phosphorus is the most important nutrient that limits the growth of phytoplankton. Phosphorus thresholds for the most common bloom forming cyanobacterial genera range from 10 to 55  $\mu\text{g L}^{-1}$  and are higher in dystrophic, brown-water lakes where some of the phosphorus is bound to humic substances. Cyanobacteria and some green algae have low levels of omega-3 fatty acids ( $\omega$ -3 FAs), especially EPA and DHA, while it is higher in cryptomonads, dinoflagellates, euglenoids, and some diatoms. EPA and DHA are essential for the growth and reproduction of zooplankton and fish, as well as for human health. Because the ability of phytoplankton to synthesize EPA and DHA varies between phytoplankton groups, phytoplankton composition determines the production of  $\omega$ -3-FAs in the lake. The higher the number and proportion of phytoplankton synthesizing  $\omega$ -3-FA, the higher the concentration of  $\omega$ -3-FA in fish. To get the same amount of EPA and DHA from fish, we need to eat a larger amount, almost twice as much fish caught from a eutrophic or dystrophic lake as fish caught from a clear-water, oligotrophic lake. It is therefore important to know how eutrophication and browning of waters affect the structure of food webs, but do we have enough information, for example, on the effects of climate change on lake communities?

#### **Q & A with Alan Gilmer**

*Because of time constraints a single question was presented reflecting several inputs*

**Question:** Will cyanobacterial blooms increase in the future and does the occurrence of cyanobacterial blooms increase under ice?

**Answer:** The question of the future is really a question of how will the drivers of cyanobacterial blooms change and this is intimately connected to climate change. There is strong evidence that cyanobacterial blooms are related to localised nutrient enrichment which is driven by rainfall events. As the climate warms in the temperate latitudes the occurrence and intensity of rainfall events has increased and with this shift in the climate system has come a concomitant increase in runoff carrying with it a heavy load of nutrients and sediment from the surrounding catchment. These sediments and nutrients become concentrated in the lakes and streams of the catchment and this leads to an increase in the frequency and intensity of cyanobacterial blooms.

We are also seeing cyanobacterial blooms occurring under ice. This is a direct consequence of the thinning of the ice and reduced snow cover which allows more light to reach through to the water underneath promoting the cyanobacterial bloom. This is probably also enhanced by a greater level of nutrient seepage from the surrounding soil which is subjected to greater

through flow of rainwater as temperatures are higher for a longer period at the start and end of winter.

#### **4. Water Pollution and its importance in human health**

*Presented by: Vivien Pohl, ESHI, TU Dublin, Grangegorman, Dublin.*

Water is a basic need for all humans. However, many of Europe's freshwater systems have been subjected to pollution events, in some cases over extended periods of time, and consequently these waterways now present as poor in overall quality terms. Anthropogenic pollution sources include waste water discharges, excessive use of pesticides and fertilizers, and the waste by-products of the pharmaceutical industry, among others. The agricultural sector presents a special problem given its scale in terms of land use, the multiplicity of practices and the widespread intensity of production. A particularly striking issue is the routine application of synthetic fertilizers and the mix of management practices in their use. Pollutants present in natural waters can have a direct effect on both ecosystems and human health. Indeed, human health is linked to ecosystem health, not just through direct food source pathways, but also through water use in irrigation, waste water treatment and management, water extraction (potable waters) and by way of ecosystem services.

Knowledge of the nature and pathways of defined pollutants e.g. nitrogen ( $\text{NH}_3$ ) and their interaction with freshwater systems, including emissions to the atmosphere in the form of fine particulate matter, is poorly understood. This is particularly significant given the strong role that weather patterns have on pollutant dynamics which in an era of changing climate adds to the level of associated uncertainty. These gaps in understanding need to be addressed if meaningful management strategies are to be developed to deal with the effects of pollution events. The approach in the study presented is to investigate water-nitrogen pollution and the transmissivity of intermediate species in generating aerosols (fine particulate matter) in an arable agricultural setting. Preliminary results suggest a link between increased levels of nitrate and ammonia in streams and ponds and in sheet flow, rill flow or through flow in soil. This affects the eutrophication potential of water bodies on the site and poses a direct hazard to human health if consumed. Additionally, the aquatic environments at these sites can become toxic to the inhabiting flora and fauna. By observing these changes in the dynamics of the ecosystem, and by tracing causality in pollutant propagation it is possible to address these knowledge gaps. This in turn can aid development and adaptation of mitigation strategies designed to help implement the provisions of the Water Framework Directive and other water quality regulations with concomitant impacts on human health.

#### **Q & A with Alan Gilmer**

*Because of time constraints a single question was presented reflecting several inputs*

**Question:** What changes in agriculture and within the policy framework in-place are needed in order to lower emissions?

**Answer:** Agriculture responds to the expectations of society and like any business it seeks to maximise return for investment. However, unlike many businesses agriculture has a responsibility that goes beyond the traditional boundaries of economics. Landscape is the template of agricultural production and as such agriculture is intimately connected with the environment. Consequently, mis-management in agriculture has the potential to cause harm across a wide spectrum of the natural system not least of which is human health. Few industries have such a profound impact on human health as agriculture, yet we hear an often repeated call for enhanced production and for an expansion of output which simultaneously promotes sustainability. The idea that agricultural intensification can run, hand in glove, with sustainability is a misconception. We cannot achieve true sustainability while pushing for more and more to be generated from the same land base – there are natural limits to this process, an optimum point beyond which it is not possible to proceed without causing harm. What is needed is a shift in agricultural philosophy away from the adage that ‘more is better’, and an outlook that seeks to maximise profit through increasing pressure on a system that in many ways, has been pushed beyond its natural boundaries. We readily see large swathes of land devoted to the production of animal feed when it has been widely recognised that animal production is a poor pathway for energy capture as food, and hence a poor use of the land resource. In this regard a shift away from intensive animal production would do much to alleviate environmental pressure and shift the balance towards sustainability with obvious benefits in terms of nitrogen, carbon and other GHG emissions, reduced pollution of waterways and improved utility of resources including water treatment, water abstraction and utilization, etc.

## **5. One Health - How to prevent infectious diseases transmission in freshwater systems**

*Presented by: Gertjan Geerling, Water Environment and Health, Deltares, Delft.*

Human health is influenced by water in many ways. The determinants of health consist of social and environmental 'layers' around us. Layers close to our daily lives are lifestyle, community, the local economy and daily activities. All of which bring contact with water, for example through food consumption or leisure activities.

On the larger scale, we are all embedded in the built environment and natural environment. These environments or ecosystems are often impaired causing health impacts directly, such as through flood events or water pollution; or indirectly through the ecosystem, e.g. increased infectious disease risk by mosquitos or reduced food yields.

Ecosystem management, or more particularly water management, can influence human health, so the co-management of these systems would increase the chances of benefits emerging. Linking water and health investments in the water system can lead to trade-offs in terms of health costs. Getting water managers and health managers on the same page is our mission. Therefore, Deltares is working to connect its water management tools to health

relevant indicators, for example the DALY, or Disability Adjusted Life Years indicator in use with the WHO. It is important to link the health burden of toxic substances, plastics or other pathogens in normal circumstances with that arising during extreme events such as floods. Equally it is important to consider the effects of water system interventions, like dams, that have many benefits but also produce health impacts such as increasing the mosquito habitat area which can lead to a greater occurrence of malaria.

The ideas imbedded in the One Health approach suggest that we need to: (i) think in terms of a connected vision, a "One Health" model, recognising how ecosystems and climate changes are related to human health; (ii) bring water and health stakeholders together, in order to devise a common language and collaboratively design solutions; and (iii) establish cross-sectoral funds to accelerate and implement water & health co-management.

### **Q & A with Alan Gilmer**

*Because of time constraints a single question was presented reflecting several inputs*

**Question:** ‘One Health’ is about linking health and environmental research and practice so that they can more effectively work together to mitigate the risks of emerging diseases. However, this process is highly dependent on the socio-political context and the recognition of vested interests and how this plays out in practice – how do we tackle this challenge?

**Answer:** Implementation of the One Health philosophy needs to recognise the relevant social and political landscape. This is easier to say than do, as there are often significant ethical, legal and institutional barriers that have to be overcome. The principles may be readily recognised, and the broad societal benefits agreed upon, but then the implementation may become stalled at bottlenecks of control rooted in short termism and narrowly defined political interests. Tackling this at the water-health-climate nexus (or in any cross sectoral setting) requires a change in how we see the problem. It is too easy to just push responsibility downline, to suggest that society must take responsibility when the context, the ‘realpolitik’ in which decisions take place has a different and often contradictory philosophy driven by neo-liberal models of self-interest. Real change and a more far reaching implementation of the One Health model requires recognition of the complex and contingent sets of relations that are involved and the interplay with socio-economic and socio-political drivers. It requires a shift in socio-political philosophy that embraces a deeper ecology which allows society to have a truly wider choice set in terms of implementation and in responding to the challenges of water and health. What is truly at the heart of this is the need for a fundamental shift in governance and public values.

## Review & Discussion

*Presented by: Jyrki Laitinen, Sustainable Water Services, SYKE, Helsinki.*

The presentations and Q&A were followed by a brief overview of the contributions and an exploration of the implications in terms of water and human health and the potential for EurAqua (and its member organisations) to contribute at the EU / national level to emerging research and innovation opportunities.

### Presentations overview

This series of webinar presentations clearly underscores the diversity and intensity of research and development taking place throughout the EU and beyond and demonstrates the potential to harness ideas, promote cross fertilization in innovation and extend collaboration. Anna-Stiina Heiskanen (SYKE, Chair of EurAqua) opened the webinar with an introduction describing the role of EurAqua as the European Network of Freshwater Research Organisations and host of this webinar and as such set the scene for the five guest presenters. The first presenter was Fabrizio Stefani (IRSA-CNR) who opened with a discussion of the infectivity profile of the SARS-CoV-2 virus in various receiving water bodies and also considered the potential development of new detection methodologies. This was followed by Fraser O'Halloran (CDP Europe) who described how while wash facilities were a commonly recognised good practice in promoting health in industry there was notable evidence of a lag in implementation, particularly given the importance of these practices in the light of the global Covid 19 pandemic. However, leveraging change through investment contingencies, market forces and a heightened sense of CSR can do much to promote a shift in outlooks. Then Kristiina Vuorio (SYKE) discussed the occurrence of algal blooms in freshwater systems including under ice cover. The emerging evidence suggests a climate moderated response showing the sensitivity of the freshwater network to enhanced nutrient enrichment and system perturbations. This has obvious implications for human health as water quality is affected and propagation pathways of environmental impacts altered. Then Vivien Pohl described the role of agriculture in affecting water quality and the clear links between land-use practices in agriculture, water and human health. She noted that water is a vector for many pathogens and pollutant species and that we are seeing the consequences of agricultural intensification in water quality (among other areas of the natural system). Clearly the sustainability of this remains uncertain. Finally, Gertjan Geerling (Deltares) presented an overview of the One Health programme and stressed the importance of the relationship between managing the environment and managing the health of human populations. Optimising health management requires a clear recognition of the interconnectedness of the environmental and human systems. Developing this link is not just a technological challenge but also an ideological and societal challenge requiring a new and more inclusive model for sustainable development particularly in the face of environmental challenges such as the Covid 19 pandemic.

### EurAqua & the Research Focus

EurAqua as the European Network of Freshwater Research Organisations has a clear mission to facilitate and improve water research and support the development of knowledge-based water management and policy. This webinar sought to support this mission in addressing research and innovation in the European Water Management sector particularly in terms of

human health including pandemics and Covid 19. In doing this the webinar provided a platform to highlight collaborative opportunities for novel approaches and cutting edge research which can be linked to the innovation and support initiatives of Horizon Europe, the Green Deal and the JPI Water 4All partnership among others. Based on the content of presentations, the follow-up question and answer sessions, and the off-line queries and comments received during and after the webinar, a number of themes can be distinguished that can help guide EurAqua and its membership in terms of refining its mission to advance collaboration, networking and innovation.

#### *Policy Implementation*

The webinar provided evidence that in order to promote greater investment in water management and ecosystem restoration we need to see greater implementation of existing regulations and protocols. Indeed, there is evidence of an implementation gap and understanding why this is so represents an important question that needs to be addressed. In some instances promoting water quality and health may seem to hinge on the issue of enforcement and understanding why this is necessary may require the development of a broader model of institutional behaviour and social compliance.

#### *Policy Integration*

There is a need for greater synergy between water related objectives across policy platforms at EU level, particularly in the areas of agriculture, energy and transport. As has been noted by some speakers, addressing this challenge requires insight and understanding of the competing pressures and the socio-political context in which the policies are developed which in turn requires recognition of the embedded social values, vested interests, and governance models.

#### *Pollution Detection*

It is evident that enhanced water management requires a fresh approach to tackle chemical pollution including measures such as the Inception Impact Assessment approach and the use of targeted stakeholder consultation. This challenge is particularly acute in some sectors such as with pharmaceuticals where the use of water and the associated impacts on water quality are considerable. To this end the pharmaceutical sector has accepted that the way environmental risks are addressed needs to be improved so that the regulatory framework addresses the environmental implications of production, use and disposal. This aspect of pollutant detection was also highlighted in some of the presentations and once again demonstrates the level of sophistication in existing technologies and the opportunity for new insights and new approaches through enhanced collaboration.

#### *Pollution System Dynamics*

It was noted during the webinar that the challenges of addressing water quality and its impacts on human health are multifaceted and complex as evidenced by such issues as the presence of microplastics, emerging pollutants and antimicrobial resistance. Hence there is also a need to focus attention on pollution (system) dynamics such as bio-accumulation, bio-magnification, cross-resistance and hormone-disrupting chemicals. Meeting these challenges will require a Water-Smart Society with detailed knowledge of environmental processes, in

conjunction with multidisciplinary and cross-sectoral collaboration and careful monitoring along the value chain.

#### *Decision Support Systems & Pollution*

It has also been widely recognised and reported by some speakers that optimising the outcomes from a human health and environmental perspective requires the existence of effective management systems. Hence, there is a clear need to develop better linkages between water managers and those responsible for health management including greater clarity, lines of communication and better systems of information management such as data streamlining, simplification and digitalization.

#### *Networking - European Green Deal*

This webinar sought to promote an open exchange of information, ideas, knowledge, practice and know-how in water management, natural water system dynamics, water investment and infrastructure and water quality control, all within the context of human health (including pandemics and Covid 19). This objective was clearly set in the context of the European Green Deal and the Water 4All Partnership initiative which collectively seek to achieve broad engagement, strong collaboration, cutting edge innovation and creativity. In this context the webinar promotes targeted networking to inspire and connect research centres and individuals in tackling our common challenges. The Horizon 2020-funded European Green Deal acknowledges that water plays a fundamental part in addressing the state of the European environment while acknowledging the great potential water has to promote economic growth and job creation.

## **Conclusion**

Generally, participants received the webinar positively and appreciated the enthusiasm and practical examples provided by the presentations. The webinar helped to highlight knowledge gaps and the potential future direction of research in water management and policy. In particular it generated a number of interesting outputs or recommendations that can help guide the strategic research and innovation agenda within EurAqua and its membership. It also provided an opportunity to promote partnerships and linkages that will improve coordination and develop synergies at a European level.