



# Report 2018

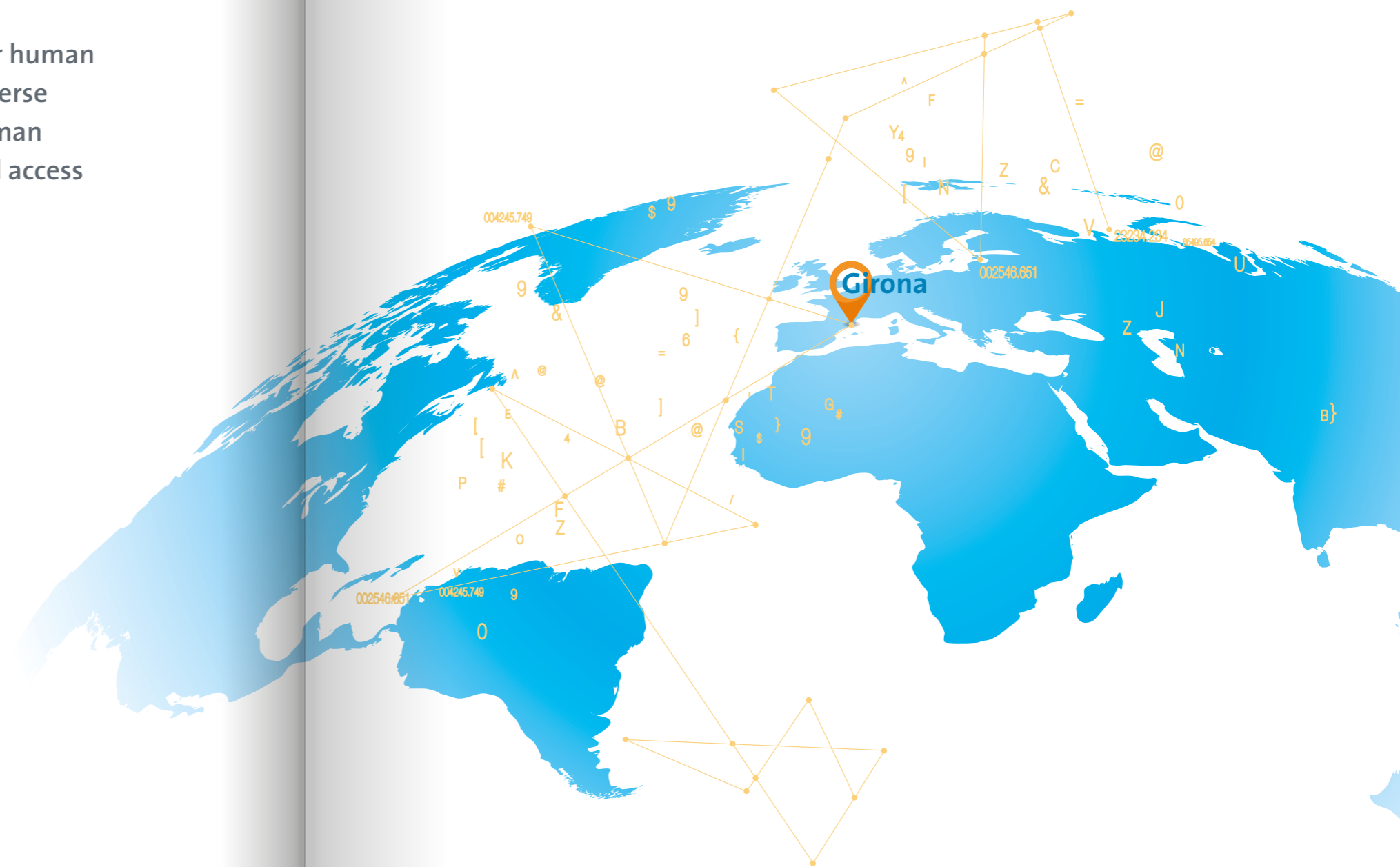


Institut Català  
de Recerca de l'Aigua  
Instituto Catalán  
de Investigación del Agua  
Catalan Institute  
for Water Research

RESEARCH INSTITUTE ATTACHED TO THE UNIVERSITY OF GIRONA

# Report 2018

This new proposed Directive on the quality of water for human consumption shall protect human health from any adverse effects of any contamination of water intended for human consumption and should promote as well the universal access of such water in all EU. (Drinking Water Directive)



# CONTENTS

## Annual Report 2018 ICRA

01	PRESENTATION	6
02	ORGANISATION	8
	• BOARD OF TRUSTEES	10
	• COMMITTEES	12
	SCIENTIFIC ADVISORY COMMITTEE	12
	PUBLIC ADMINISTRATION AND BUSINESS MIXED COMMITTEE	14
	• DEPARTMENTS & STAFF	15
	• R&D&I SUPPORT SERVICES	16
	ADMINISTRATION	16
	R&D&I OFFICE	17
	TECHNICAL-SCIENTIFIC PLATFORMS: SCT & PLANTEA	18
	• FRAMEWORK DIRECTIVE PROJECT	23
	• HR EXCELLENCE IN RESEARCH AWARD	24
	• EQUALITY GENDER PLAN	25
03	RESEARCH AREAS	26
	• AREA I – RESOURCES AND ECOSYSTEMS	28
	• AREA II – WATER QUALITY	36
	• AREA III – TECHNOLOGIES AND EVALUATION	46
04	PUBLICATIONS & CONGRESSES	54
05	PROJECTS	68
06	CONTRACTS	78
07	AGREEMENTS	82
08	OTHER DISSEMINATION ACTIVITIES	86
09	AWARDS	102
10	FINANCING	104
11	ICRA IN THE NEWS AND PRESS	106

©Copyright 2019

Report 2018  
Edition 2019. Catalan Institute for Water  
Research (ICRA)

Graphic design amb layout  
TRES Y MÁS, S.C.

Corrections  
AADIMATIQ

Printing  
IMPRESA PAGÉS

Legal diposit  
GI 1704-2019







# 01 PRESENTATION

Welcome,  
I am pleased to present the 2018 Activities Report of the Catalan Institute for Water Research-ICRA Foundation.

As you will see later on in this book, ICRA continues to grow year after year and its research and science dissemination operations are extensive and relevant bearing in mind the number of researchers we have. Its international engagement and recognition as a world-class facility is reflected in the number of national and European projects achieved. As an example, this year ICRA has received the ITN NOWELTIES (H2020-MSCA-ITN-2018), a project with significant financial value led by Dr Mira Petrovic in the field of Water Quality, and involving more than twenty European partners and institutions.

This acknowledgement is also evident in the extensive participation of its researchers in key science forums, giving guest talks and sharing the results of their research, as well as the high number of scientific publications in front-rank journals.

2018 has also seen the onset of ICRA's next Strategic Plan. After our first 10 years and with all the changes this has entailed since the first Strategic Plan, researchers and management with the input and support of the Scientific Committee have begun drafting the document that will be the basis for drawing up the ICRA's 2020-2024 Strategic Plan.

As in previous years, I'd like to acknowledge all the people who makes part of the ICRA team, as without their commitment, engagement and enthusiasm ICRA would not be where it is today. Also a hat tip and thanks to the researchers and support staff who have been here and for various professional reasons have embarked on different journeys.

I hope you find it an interesting read.

Yours faithfully,  
**Damià Barceló**  
DIRECTOR





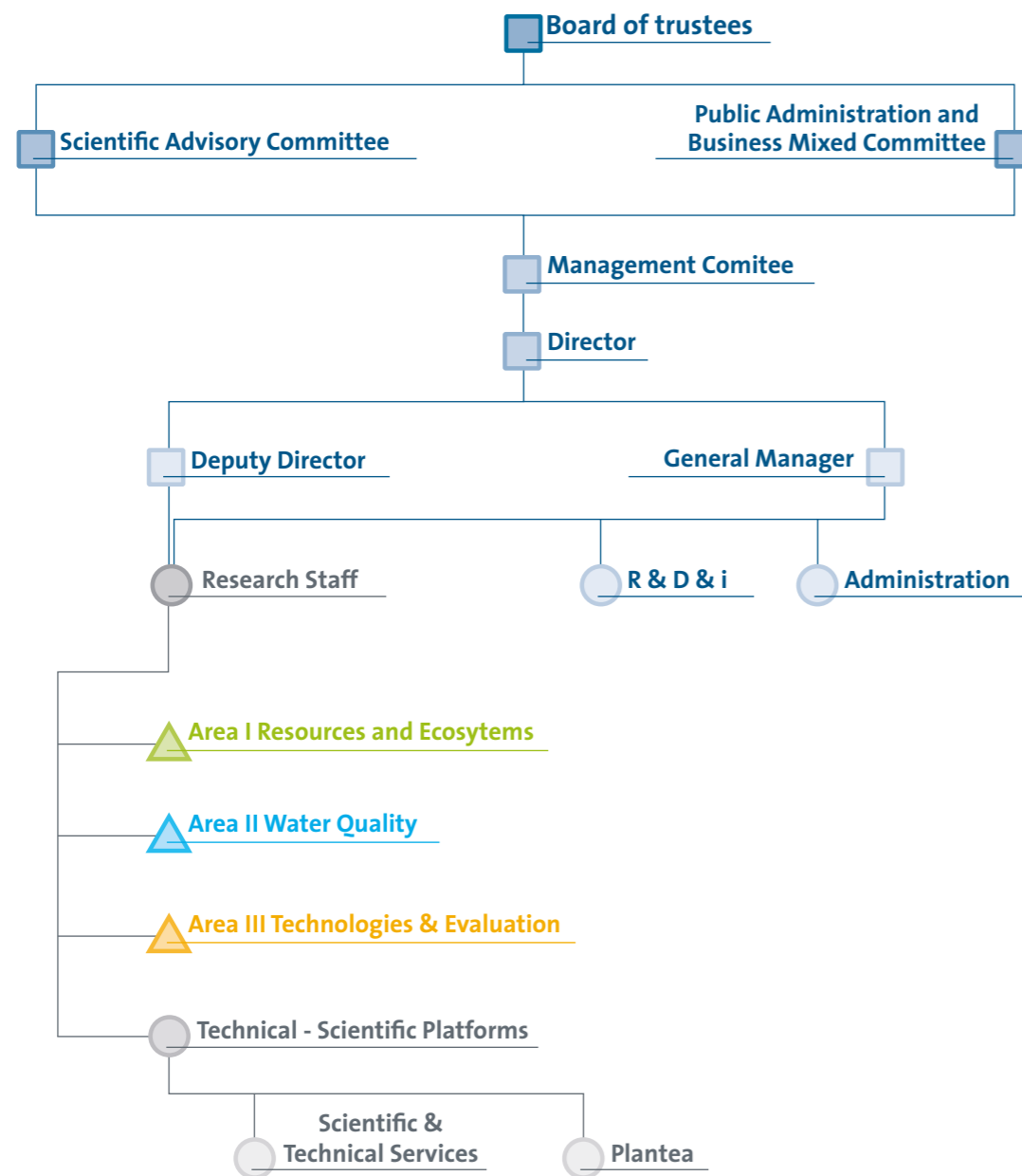
# 02 ORGANISATION

- BOARD OF TRUSTEES
- COMMITTEES
- DEPARTMENTS & STAFF
- R&D&I SUPPORT SERVICES
  - ADMINISTRATION
  - R&D&I OFFICE
  - TECHNICAL-SCIENTIFIC PLATFORMS: SCT & PLANTEA
- WATER FRAMEWORK DIRECTIVE PROJECT
- HR EXCELLENCE IN RESEARCH AWARD
- EQUALITY GENDER PLAN

# BOARD OF TRUSTEES

The Board of Trustees is ICRA's highest governing body. The trustees are the Catalan Regional Government's Ministry of Business and Knowledge (DECO), the Catalan Water Agency (ACA) and the University of Girona (UdG).

In 2018, the ICRA Board of Trustees has met twice. An extraordinary session was held on 14/5/2018 to discuss and make decisions on (approval CSIC agreement extension addendum by ICRA management). The annual general meeting was held on 28/6/2018 to make decisions about operations for the year.



## MEMBERS

### CHAIR

**Minister of the Regional Government of Catalonia competent in research matters (ex officio member): vacant** [Senate Chair Agreement of 27 October 2017, publishing the Senate Plenary Session Agreement approving the measures required by the Government under the aegis of article 155 of the Constitution] (until May).

**M. Àngels Chacon i Freixes** (from 4<sup>th</sup> June)  
Minister for Business and Knowledge  
Ministry of Business and Knowledge  
Regional Government of Catalonia

**Joan Gómez Pallarès** (from 26<sup>th</sup> July)  
Managing Director of Research  
General Directorate of Research  
Ministry of Economy and Knowledge  
Regional Government of Catalonia

**Anna Albar**  
Managing Director  
Science and Technology Park  
University of Girona

**Josep Calbó**  
Pro-Vice-Chancellor of Strategic Projects  
University of Girona

**Jordi Agustí**  
Director of the Catalan Water Agency  
Catalan Water Agency  
Ministry of Territory and Sustainability  
Regional Government of Catalonia

### DEPUTY CHAIR

**Joaquim Salvi**  
Vice-Chancellor  
University of Girona

### MEMBERS

**Arcadi Navarro** (until June)  
Secretary for Universities and Research  
Secretariat for Universities and Research  
Ministry of Economy and Knowledge  
Regional Government of Catalonia

**Francesc Xavier Grau i Vidal** (from 5th July)  
Secretary for Universities and Research  
Secretariat for Universities and Research  
Ministry of Economy and Knowledge  
Regional Government of Catalonia

**Francesc Ramon Subirada** (until June)  
Managing Director of Research  
General Directorate of Research  
Ministry of Economy and Knowledge  
Regional Government of Catalonia

### TRUSTEE SECRETARY

**Lluís Rovira**  
Director of CERCA (Catalan Research Centres)  
General Directorate of Research  
Ministry of Business and Knowledge  
Regional Government of Catalonia

### NON-TRUSTEE DEPUTY SECRETARY

**Josep M. Alcoberro**  
Legal Department of CERCA (Catalan Research Centres)  
Ministry of Business and Knowledge  
Regional Government of Catalonia

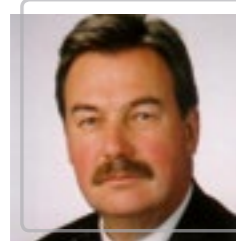


# COMMITTEES

## SCIENTIFIC ADVISORY COMMITTEE

The Scientific Advisory Committee is appointed by the Board of Trustees and includes an unspecified number of scientists of acknowledged repute and expertise in the field of water and all other related areas of science. This Committee's membership represents the ICRA's different priority areas of research. One of its most significant tasks is to ensure the quality of the research carried out at the ICRA. Accordingly, it acts as an advisory body for all issues relating to the scientific activities submitted for its consideration and, when requested, it will also act as an evaluating body for these activities.

In 2018 the Committee met at its two-yearly session on 28-29 May. On the first day all the researchers presented their work over the last two years. At these sessions, the ICRA's management in conjunction with the senior researchers presented a proposal for a new ICRA Strategic Plan 2018-2021. On the last day, the Scientific Committee presented a document with its considerations and recommendations for the proposed Strategic Plan presented by ICRA, which also included recommendations on the direction of future project proposals.



**Bernd Bilitewski**  
Chair of the Scientific Advisory Committee. General Commissioner for Foreign Affairs. Head of the Institute for Waste and Pollutant Management, Dresden University of Technology (DE)



**Inmaculada Ortiz Uribe**  
Head of the research group in Advanced Separation Processes. Faculty member of the Department of Chemical Engineering and Inorganic Chemistry, University of Cantabria, Santander (ES)



**Clifford Dahm**  
Emeritus Professor of Department of Biology, University of New Mexico, Albuquerque (USA)



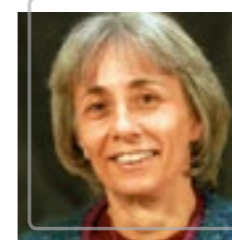
**Edward Furlong**  
Head of the Methods Research & Development Program, National Water Quality Laboratory, US Geological Survey, Denver Federal Center, Denver, CO (USA)



**Gustaf Olsson**  
Emeritus Professor of Industrial Automation, Department of Industrial Electrical Engineering and Automation (IEA), Lund University, Lund (SE)



**Amadeo Rodríguez Fernández-Alba**  
Head of the European Reference Laboratory for Pesticides. Faculty member of the Department of Hydrogeology and Analytic Chemistry, University of Almería, Almería (ES)



**Jeanne Garric**  
Director of the Ecotoxicology Laboratory, Aquatic Ecosystems Biology Unit, Department of Water Quality and Pollution Prevention, IRISTEA (FR)



**Maria Reis**  
Full Professor in Environmental Biotechnology, Department of Chemistry, Sciences and Technology Faculty, University Nova of Lisbon (UNL), Portugal (PT)



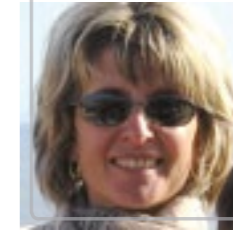
**Emilio Custodio Gimena**  
Emeritus Professor of the Department of Geotechnical Engineering and Geosciences, Groundwater Research Team of the Polytechnic University of Catalonia, Barcelona (ES). Correspondent member of the Royal Spanish Academy of Sciences. President of the Advisory Committee of the Fundación Centro Internacional de Hidrología Subterránea (FCIHS)



**Peter Vanrolleghem**  
Holder of the Canada Research Chair on Water Quality Modeling (modelEAU) and Professor of the Department of Civil Engineering and Water Engineering, Université Laval, Quebec, Canada (CA)



**Georg Teutsch**  
Scientific Managing Director of the Helmholtz - Centre for Environmental Research (UFZ) at Leipzig, Germany (DE), Full Professor in Hydrogeology at the same centre, Member of the National Committee for Global Change Research, Member of the German Commission on Water Research



**Paola Verlicchi**  
Professor in Environmental and Sanitary Engineering, Engineering Faculty, Department of Engineering, University of Ferrara, Italy (IT)



**Jörg Overmann**  
Director of the Leibniz-Institute German Collection of Microorganisms and Cell Cultures (DSMZ) and Head of the Department Microbial Ecology and Diversity Research, Leibniz, Germany (DE)



**Susan D. Richardson**  
Arthur Sease Williams Professor of Chemistry, Department of Chemistry & Biochemistry, University of South Carolina (USA)



**Peter-Dietrich Hansen**  
Director of the Department of Ecological Impact Research and Ecotoxicology, Berlin Institute of Technology (BIT), Germany (DE)



**Stan Gregory**  
Emeritus Professor, Department of Fisheries & Wildlife, Oregon State University (USA)



## PUBLIC ADMINISTRATION AND BUSINESS MIXED COMMITTEE

The Public Administration and Business Mixed Committee is the body for business participation in the Foundation. It may be consulted by the Board of Trustees and by the Director and may issue recommendations for guidance.

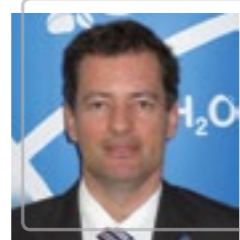
The functions of the Public Administration and Business Mixed Committee are:

- Assisting in detecting industry needs and suggesting specific business proposals
- Identify attractive technology development opportunities
- Promote participation in joint research projects and facilitate access of the Foundation to public and private resources
- Assist in the creation of spin-offs
- Participate in activities related to the Foundation's objectives

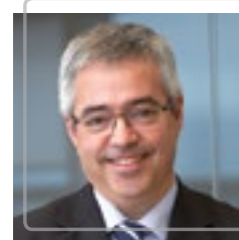
This year, the Public Administration and Business Mixed Committee has not been convened as its sessions are held every two years. The next meeting is scheduled for autumn 2018.



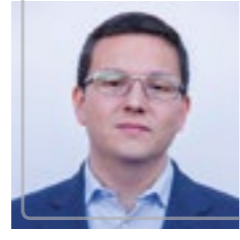
**Xavier Tristán Prat**  
**Chair of the Business Committee**  
 Acting Manager of the Costa Brava Consortium (CCB) and Head Engineer for Technical Services at the CCB. Member of the Advisory Council for the Sustainable Development of Catalonia (CADS)



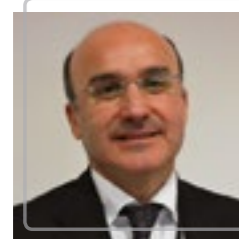
**Sergi Martí Costa**  
 Managing Director of STENCO, AQUA AMBIENT IBÉRICA and TRAINING INDUSTRIAL.



**Jaume Carol Pañach**  
 Managing Director of FLUIDRA. President of the Catalan Water Partnership (CWP), the Catalan Water Cluster and member of the Catalan Sports Cluster Board (INDESCAT)



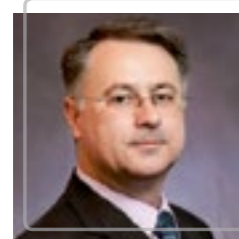
**Carlos Montero**  
 Managing Director of CETaqua



**Jesús Gómez del Blanco**  
 Managing Director of RECIPHARM Parets S.L.U., the Spanish subsidiary of RECIPHARM AB (Sweden)



**Antonio Ordóñez**  
 Director of Research, Development and Innovation - GS INIMA Environment, S.A.



**Jorge Juan Malfeito Sánchez**  
 Director of R&D&I at ACCIONA Agua S.A.



**Valentin Garcia**  
 Director of Hydraulic Public Works, National and International, at SOIL AGUAS, SOIL Group

## DEPARTMENTS & STAFF



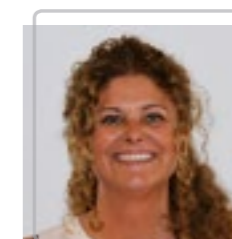
**DIRECTOR**  
**Damià Barceló**  
 Research Professor and Deputy Director of the Institute of Environmental Assessment and Water Studies (IDAEA), of the Spanish National Research Council (CSIC)



**DEPUTY DIRECTOR**  
**Sergi Sabater**  
 Full Professor of Ecology at the University of Girona. Head of ICRA's Resources and Ecosystems Research Area



**GENERAL MANAGER**  
**Iván Sánchez**  
 General Manager



**EXECUTIVE SECRETARY**  
**Olga Corral**  
 Executive Secretary, Director's Office



In 2018,  
**110** people contributed to ICRA's R&D&I activities  
**81** Research personnel  
**19** Management/Administration personnel  
**4** R&D&I personnel  
**6** Framework Directive Project personnel



# R&D&I SUPPORT SERVICES

The General Manager of ICRA is responsible for all the basic services that provide support for R&D&I:

- ADMINISTRATION
- R&D&I OFFICE
- TECHNICAL AND SCIENTIFIC PLATFORMS:
  - > Scientific and Technical Services (SCT)
  - > PLANTEA

## ADMINISTRATION

In 2018, the active administrative services that performed specific functions within each field of activity were:

- Human Resources
- Purchasing and Procurement (Outsourcing)
- Finance and Accounting
- Information Technologies
- Communication, Image and Promotion
- Quality and Environment
- General Services

The Outsourcing Service has managed 3 types of contract: services, supplies and construction, with the objective of providing ICRA's 3 research areas and the SCT with both basic and special scientific equipment.

This equipment has been 50% co-financed by the EU's European Regional Development Fund (ERDF) under the Catalan ERDF Operative Programme 2007-2013 and it also received funding from MINECO (the Spanish Ministry of Economy and Competitiveness), directly and through the Third Additional Provision (DA3<sup>a</sup>) of the Catalan Statute of Autonomy.

- General Manager – **Iván Sánchez**
- Executive Secretary, Director's Office – **Olga Corral**
- Human Resources Head – **David López**
- Eco-Fin Head – **Susana Roca**
- Accounting and Support to Research – **Neus Fàbrega** – **Olga Fernandez** (until February)
- Administration Technician – **Estefania Romero** (until January)
- RDI Technician – **Esther Llorens**
- IT – **Rubén Díaz**
- Reception – **Pere Royo** – **Sandra Monleon** – **Carla Santiago**
- Maintenance – **Daniel Molina** (until May)
- Visiting Students
- Administration
- Jenifer Avila** – Internship Student, Montilivi HS (Girona)



From left to right: Iván Sánchez, Pere Royo, David López, Olga Corral, Laura Sancho, Janina Manrique, Rubén Díaz, Esther Llorens, Susana Roca, Sandra Monleón

## R&D&I OFFICE



From left to right: Rina Weltner, Jaume Alemany, Arnau Mulo

- R&D&I Office Manager – **Jaume Alemany**
- European and International Project Officer – **Laura Bertolini**
- Project Manager – **Rina Weltner**
- Administration Technician – **Arnau Mulo**

### Objectives and activities of the R&D&I Office

The purpose of the R&D&I Office is to enhance the capacity of ICRA to scale research and gain international prestige by attracting external funding and partnerships. The operational objective of the Office's activities is therefore to increase the participation of the ICRA's research groups in nationally and internationally funded basic and applied research projects and to increase industry connections through the application of research results.

The Office assists ICRA's researchers in the definition and implementation of a strategy for participation in research-grant funding initiatives at the local, national and international level. We also offer our researchers full support for calls search and proposal preparation and presentation, as well as advice on all proposal-related financial and legal issues. Finally, we provide full support for the administrative and financial management of successful grants and technology transfer contracts with local and International enterprises.

In 2018 ICRA presented or participated in 20 European proposals, 3 of which were successful: 1 Marie Curie Skłodowska Action Individual Fellowships, and 2 H2020 Societal Challenge collaborative projects, for a total of almost €1 M. At the moment the European and international projects unit is managing a total of 15 projects including the ERC Starting ELECTRON<sub>4</sub>Water involving pioneering, chemical-free water purification technology using a three-dimensional (3D) nanoelectrochemical system equipped with low-cost reduced grapheme oxide (RGO)-based electrodes.

In terms of national funding, during 2018 a total of 22 proposals were submitted to Spanish and Catalan funding agencies; of those 7 have been

awarded for a global amount of €349,000 (32% success rate) and 12 proposals are still pending resolution for a global amount of €1.5 M.

In 2018 the National Projects Unit has managed 17 research projects, 16 funded by the Spanish National Funding Agency and Spanish Ministry of Science, Innovation and Universities (AEI-MCIU) and 1 project funded by the Catalan Agency for Competitiveness (ACCIÓ) and ERDF; 19 Fellowship Grants (12 funded by AEI-MINECO and 7 by the Catalan Agency for Management of Universities and Research Grants - AGAUR) and 6 networking projects funded by AEI-MIECO and other institutions.

As for the Knowledge and Technology Transfer (KTT) Unit, a total of 7 collaborative contracts have been signed with private companies and public entities during 2018 for a global amount of € 170.000. Although the number of projects decreased compared to 2017, their global amount increased because there has been a slight rise in individual budgets reflecting higher commitment from companies.

In 2018 ICRA joined the GINJOL Patents Fund in order to support our Knowledge and Technology Transfer projects, specifically in terms of protecting intellectual and industrial property rights. GINJOL includes other CERCA institutes and awards funding which may be used to finance the services needed to protect, exploit and market the results of research. The GINJOL Fund was presented to researchers, and the R&D&I Office in close partnership with the KTT Committee encouraged them to take part by presenting proposals. The commercial potential of some research results is being evaluated.

Our aim for 2019 is to work intensively with international consortia in order to prepare and present at least 20 European/international proposals as we did in 2018. Apart from H2O2O calls, we will be working to actively participate in the WATER JPI and the new Partnership on Research and Innovation in the Mediterranean Area (PRIMA) calls.. ICRA will also participate in the forthcoming calls issued by the ERC Starting, Consolidator, and Advanced Grants, as well as the ENI CBC MED and by water/climate-related ERA-NET Initiatives.

ICRA is very actively involved in collaborations with national and international research and technological partners, contributing to the drafts of strategic implementation plans and future calls related to different European initiatives in

the field of water science. ICRA joined the Water supply and sanitation Technology Platform (WssTP) initiated by the European Commission in 2004 to promote coordination and collaboration of Research and Technology Development in the water industry.

ICRA is also participating in 2 COST actions: New and emerging challenges and opportunities in wastewater reuse (NEREUS) and Science and Management of Intermittent Rivers and Ephemeral (SMIRES)

Finally, we would note that in 2018 the Office appointed a part-time administrative assistant, Arnau Mullol, to provide extra support for justification tasks. This recruitment is due the increase in projects and requirements for budget justification to funding bodies.

## TECHNICAL AND SCIENTIFIC PLATFORMS

Since one of the objectives of ICRA is to transfer knowledge and provide practical solutions, the Scientific and Technical Services (STS) provide analytical services and PLANTEA for scaling up processes to pilot plant scale.

In 2018, the technical and scientific platforms have been consolidated to provide a quality scientific and technical support service to researchers.

The STS has also carried out continuous training and specialisation of technicians.

ICRA Head of SCT – **Sara Insa**

ICRA Head of SCT – **Marta Villagrasa**

Technicians – **Olga Montojo – Alex Sánchez – Natàlia Serón – Mireia Nuñez – Isabel Arenas**



From left to right: Natàlia Serón, Sara Insa, Mireia Nuñez, Àlex Sánchez, Maria Simón, Olga Montojo

These platforms are the following:

### Platform (PLANTEA)

- Scientific and Technical Services (SCT)
- Water Science and Technologies Research Platform (PLANTEA)

## Scientific and Technical Services (STS)

With the purpose of providing a comprehensive water analysis service aimed mainly at the ICRA research community, the Scientific and Technical Services (SCT) have concentrated their actions on fully optimising management of analytical processes from the planning of the experimental design to the delivery of final results.

The technical competence of the SCTs throughout 2018 has been fully justified by the high number of activities in which they have actively participated, mainly focused on physical-chemical and/or microbiological determinations of a broad spectrum of aqueous matrices from wastewater regenerated in natural waters. In order to contextualise the scope of the contribution of the SCTs, the following services provided are listed:

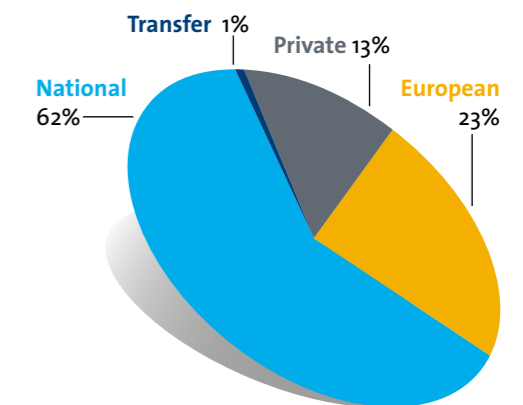
- Determination of ionic species for the study of variations in the functioning of river systems as a result of climatic and global changes.
- Measurement of nitrogen, phosphorus and sulphur for the evaluation of advanced technologies for nutrient elimination, process efficiency improvement and recovery.
- Characterisation of sulphur species for understanding the dynamics (physical, chemical and microbiological) in sewage systems.
- Determination of the presence of disinfection products in wastewater, reclaimed water and drinking water.
- Analysis of emerging organic contaminants such as drugs, antibiotics, transformation products, endocrine disruptors, pesticides, compounds classified as potential contaminants on the Watch list, etc. in environmental aqueous matrices.
- DNA extraction and quantification of antibiotic resistance genes in different aqueous matrices from samples from diverse sources such as sewage treatment plants, biofilms and public fountains.
- Application of confocal microscopy in the study of bacterial viability in activated sludge from pilot plants.

At an analytical level, it is worth mentioning the significant contribution of the SCTs in achieving results within the Water Framework Directive (WFD) project in collaboration with the Catalan Water Agency (ACA). Above all, the input of the SCTs has been distributed in the working groups engaged in the analysis of continental and coastal surface waters, where analytical methodologies have been developed for the determination of various species at trace levels such as pesticides, polycyclic aromatic hydrocarbons, volatile organic compounds, etc. This collaboration has made it possible to characterise the different areas of interest and gather the information required for future studies.

Finally, actions have been taken to upgrade the equipment assigned to the SCTs by taking part in competitive calls for scientific infrastructure grants. The SCTs added value in knowledge dissemination has been fostered in 2018 through their involvement in managing a number of educational measures such as end of undergraduate and master's degree projects.

### 1. TECHNOLOGY TRANSFER

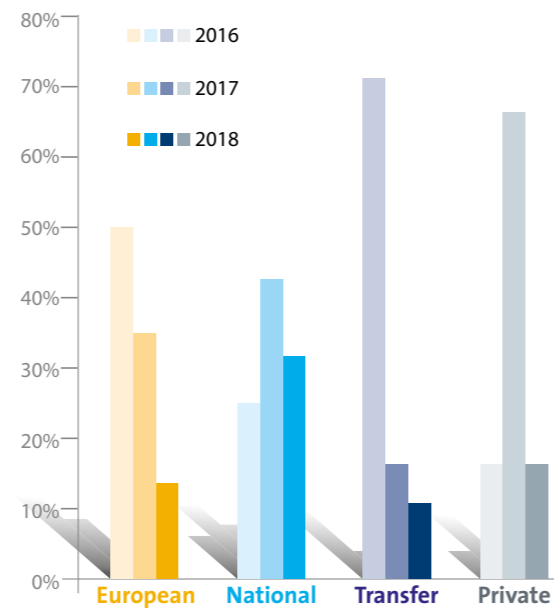
In 2018, a large part of the work carried out by the SCTs was divided into four types of projects: national, European, transfer and applications from external entities (private funds). As shown in the following figure, the operations of the services have mainly focused on the implementation of national projects.





Despite awareness of the significance of exporting knowledge to areas other than ICRA's own fields, the SCTs have experienced a slight decrease in income from transfer projects, associated to prioritising methodological development tasks in order to add to the analytical catalogue. The figure below, in which the percentages have been weighted according to the source of funds for the project, shows this downward trend over the last 3 years.

This means 2018 would be seen as a turning point in terms of SCT expansion in transfer since the growth achieved in analytical capacity should make it possible to pursue new projects in the coming years.



tems. There are two pilot-scale sewer systems simulating two rising mains from a sewer network which are being operated to study the biochemical transformations occurring in these systems. The majority of the detrimental compounds produced during wastewater transport originate in the anaerobic zones of the sewer networks, the rising mains. The two most detrimental compounds produced are hydrogen sulphide, responsible for bad odours and toxic at certain concentrations, and methane, which is the most important greenhouse gas today after carbon dioxide. These sewer pilot plants make it possible to study the chemical and microbiological transformations in these parts of the sewer networks, which are very difficult to access in real facilities. These installations, which are the first of their kind in Europe, allow researchers to investigate why and how these detrimental products form during wastewater transport and how their formation can be prevented.

The effect of temperature changes on this system has been evaluated. Also, a forward osmosis pilot plant to concentrate real wastewater has been built and is currently being operated to provide concentrated real wastewater to the anaerobic membrane bioreactor.

Additionally, as part of an ICRA-funded strategic research initiative, Marc Sauchelli carried out his research on transport of micropollutants and membrane fouling mechanisms using novel thin film composite forward osmosis membranes in flat sheet membrane filtration cells. This fundamental research contributes to assessing the performance of novel forward osmosis configurations.

Mr Luca Sbardella and Dr Inma Velo Gala have studied novel advanced oxidation processes based on the generation of sulphate radicals for secondary effluent treatment in a pilot plant employing low-pressure mercury lamps in the TREATREC project. The same pilot plant has also been used by Ms Sonnenfeld-Blaufuks in the TRICERATOPS project to study illumination design and synergistic interplay of thermal and photochemical reactions in the photo-Fenton system with the objective to reduce energy consumption.

Finally, a semi-industrial scale low energy requirement membrane bioreactor (Smart Air MBR) is also being applied in the context of the CLaEaN-TOUR project. The technology is being tested in combination with forward osmosis membranes and in comparison with a hydroponic-constructed wetland installed at Hotel Samba (Lloret de Mar) with ornamental and edible plants for treatment and reuse of greywater in the context of the circular economy.

All these installations are fully monitored and controlled by different PLC systems connected to a SCADA program, allowing real-time control of the processes taking place in each of the pilot plants. This is possible thanks to the numerous monitoring systems in PLANTEA facilities such as dissolved oxygen, pH, redox, nitrate, dissolved N<sub>2</sub>O and hydrogen sulphide sensors, as well as online gas analysers for N<sub>2</sub>O and nitric oxide (NO) monitoring connected to the SCADA system.

Finally, the PLANTEA laboratory has a direct connection to a sewage pumping station that collects the wastewater originating in local neighbourhoods. This greatly facilitates the use of real wastewater for the experiments conducted in the PLANTEA pilot plants.



## Water Science and Technologies Research Platform (PLANTEA)

The Catalan Institute for Water Research (ICRA) is the home of the Water Science and Technologies Research Platform (PLANTEA).

The Water Science and Technologies Research Platform (PLANTEA) is a space where research and industrial development projects can be carried out with pilot plants of different sizes (up to semi-industrial scale).

These pilot plants make it possible to carry out research projects on advanced treatment of both wastewater and treated water or water that can be made potable, and on projects for monitoring, eliminating and evaluating the effects of contaminants in water, as well as studies that require large-scale equipment.

This facility has been 50% co-financed by the EU's European Regional Development Fund (ERDF) under the Catalan ERDF Operative Programme 2007-2013 and also received funding from MINECO (Spanish Ministry of Economy and Competitiveness) directly and through the Third Additional Provision (DA3<sup>a</sup>) of the Catalan Statute of Autonomy.

### SCIENTIFIC-TECHNICAL PLATFORMS

The PLANTEA test platform currently provides ICRA with benchmark facilities for carrying out three different aims:

- **The study of wastewater transport and treatment systems in conditions as similar as possible to the real world (pilot plants).**
- **The study of the response of fluvial ecosystems in different conditions thanks to the installation of an experimental stream facility (ESF).**
- **An artificial aquatic mesocosm ecosystem that makes it possible to carry out studies on exposing organisms such as mussels and/or fish to chemical contaminants.**

### LAB AND PILOT SCALE PLANTS AT PLANTEA UNIT (LABORATORY L06)

During 2018 there have been several pilot plants in operation in the PLANTEA platform to mimic real wastewater transport and treatment sys-

In 2018, we have constructed and operated a new sewer pilot plant. As at the other two sewer pilot plants, this one also receives real wastewater and will be used to study the presence and mobility of antibiotic resistance genes during wastewater transport. These activities are part of ongoing project funded by the Spanish Government that started in 2016 (SEWAGENE).

Furthermore, two sequencing batch reactors (SBR) have been operated to study how temperature and rain events affect N<sub>2</sub>O emissions during nitrification. This research was conducted as part of the REACH project funded by the Spanish Government that ended in December 2018.

During 2018, the WATINTECH project funded by the EU via the JPI WATERWORKS has continued. This project proposes the combination of different decentralised treatment approaches for sewage and urban run-off to recover water, energy and valuable chemicals. Within the scope of this project, an anaerobic lab-scale membrane bioreactor (AnMBR) has been operated to assess the amount of biogas production when treating concentrated synthetic wastewater.

### The Experimental Streams Facility makes it possible to simulate the response of fluvial ecosystems to different environmental conditions

Using this facility, a study has been performed on the bioaccumulation and toxicity of fullerenes (nanoparticles) and triclosan in freshwater snails (*Radix balthica*). This experiment required biofilm colonisation for 40 days, and an experimental phase –which lasted 3 weeks.. The experiment aimed to study the toxicity of fullerenes (carbon nanoparticles-C60) and the bacteriostatic triclosan (TCS), alone and in combination, in freshwater snails in river mesocosms. Further, it aimed to determine the bioaccumulation capacity of fullerenes and triclosan in freshwater snails.

The experiment had 4 treatments using fluvial mesocosms (25 Ø x 15 cm high) during chronic 3-week exposure (Figure 1).



Figure 1 – Fluvial mesocosms used for the experiments of biofilm and snails exposed to nanoparticles and organic contaminants

The results indicated that C60 nanoparticle exposure significantly increased the grazing activity of the snails during the first week (i.e. they were fed more biofilm) compared to snails that were not exposed to nanoparticles. No sig-

nificant differences were observed in the other variables analysed, although the TCS seems to increase the reproductive effort after 3 weeks of exposure (higher number of eggs in the clutches for TCS treatments). Finally, bioaccumulation of nanoparticles was detected at the end of the experiment with C60 concentrations of 1527 ng / g dry weight in the snails and 10.2 pg / mg dry weight in the tegument (mean values). However, the weak observed toxic effects indicate that these environmental pollutants do not have ecologically relevant consequences for the ecosystem at environmental concentrations. The results of this experiment are discussed in a paper which has submitted to a scientific journal (Lopez-Doval et al. 2019).

*Lopez-Doval JL., Freixa, A., Santos, LHMLM. Sanchis, J., Rodriguez-Mozaz, S., Farré, M., Barceló, D & Sabater, S. 2019. Fullerenes and triclosan induce reproductive and behavioural alterations in the freshwater snail Radix balthica.*

### ARTIFICIAL AQUATIC ECOSYSTEM

An artificial aquatic ecosystem has been set up in the ICRA's facilities consisting of two aquarium systems of 400 L each, which can be used to recirculate salt and fresh water.

The system is equipped with protein skimmers, biological and chemical filtration, temperature control and aeration, simulating the characteristics of marine and freshwater environments. The mesocosm is thus available to perform research studies where aquatic organisms such as mussels and/or fish are exposed to chemical contaminants to study the impact of environmental pollution on these organisms and evaluate the possible implications for human consumption.



## WATER FRAMEWORK DIRECTIVE PROJECT

### Water Framework Directive Project: Strategic project on knowledge acquisition of the obligations from the Water Framework Directive

The European Commission has been adopting and publishing new legislation and requirements for monitoring and control programmes since the Water Framework Directive was published. One of its objectives is improving knowledge of the chemical state of water bodies, especially in terms of organic pollutants about which little is known. Accordingly, ICRA has undertaken the strategic WATER FRAMEWORK DIRECTIVE PROJECT. Its main objective is the determination of the appearance of priority substances and new emerging pollutants in Catalan water bodies in order to provide new tools for the improvement of their chemical state. Wi-

thin the first stage of the project, from 2017 to 2018, ICRA collaborated with IDAEA-CSIC, ICM-CSIC, and ACA.

In 2018 analytical methods have been developed and set up for the following contaminants: 1) dicofol, diuron, isoproturon, and dichlorvos for the freshwater matrices; and 2) VOCs, OCPs, PAHs,alachlor, atrazine, chlorpyrifos, chlorfenvinphos, diuron, dichlorvos, isoproturon, simazine, trifluralin and terbutylazine for the marine water matrices. Next, 1086 samples from Catalan water bodies were analysed and a total of 266 compounds were detected in 6 matrices.

Biota (fish)		Marine water	
PCDDs, PCDFs, PCB-DLs	PAHs	HBCDDs	
PCBs	Dicofol and Fluoranthene	PFASs	
Hexachlorobenzene	PFASs	VOCs	
Hexachlorobutadiene	HBCDDs	OCPs	
Heptachlor	DDXs	PAHs	
Heptachlor epoxide	PBDEs	Pesticides	
Marine sediments		Freshwater	Underground water
PAHs	DEHP	PFASs	Pesticides
OCPs	Nonylphenol	HBCDDs	River sediments
Pesticides	Octylphenol	Dicofol	HCHs
HBCDDs	PCBs	Watch List	NPEOS (n=0, n=1, n=2)
PBDEs	Heavy metals	Pesticides	PAHs

As a result, the chemical state assessment of Catalan water bodies was obtained by means of analysis of the various compounds (“new generation” pesticides, priority substances, priority hazardous substances, organic compounds and heavy metals) in the matrices. A risk assessment study for algae, *Daphnia* and fish was also done for the different chemical compounds as well as a risk assessment for the human consumption of the compounds found in Catalan groundwater.

#### Seven ICRA members are participating in the project

One project manager – **Esther Llorens**

Six research technicians – **Esther López – Vittoria Barbieri – Cristina Bosch – Manuel Garcia – Berta Sala – Ivan Vallejo**



## HR EXCELLENCE IN RESEARCH AWARD

In December 2015, the Catalan Institute for Water Research (ICRA) received the “HR Excellence in Research” award from the European Commission.

This award and its logo recognises that ICRA endorses the policies and practices of *The Human Resources Strategy for Researchers (HRS4R)*, established by the European Commission to implement principles of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers (Charter & Code).

The implementation process started in October 2014 when the HRS4R Work Group was created. After performing a gap analysis and a self-assessment in accordance with the results of the analysis obtained, a 2015-2017 Action Plan was produced.

ICRA has adopted this 2015-2017 Action Plan in agreement with HRS4R and the principles of the Charter and Code of the European Commission, focusing on key areas for change and further development.

ICRA has worked on the implementation and development of actions arising from the Action Plan 2015-2017.

Work is also being done on integration of the OTM-R Policy (Open, Transparent and Merit-based Recruitment of Researchers) into ICRA's HR Policy.



HR EXCELLENCE IN RESEARCH

## GENDER EQUALITY PLAN

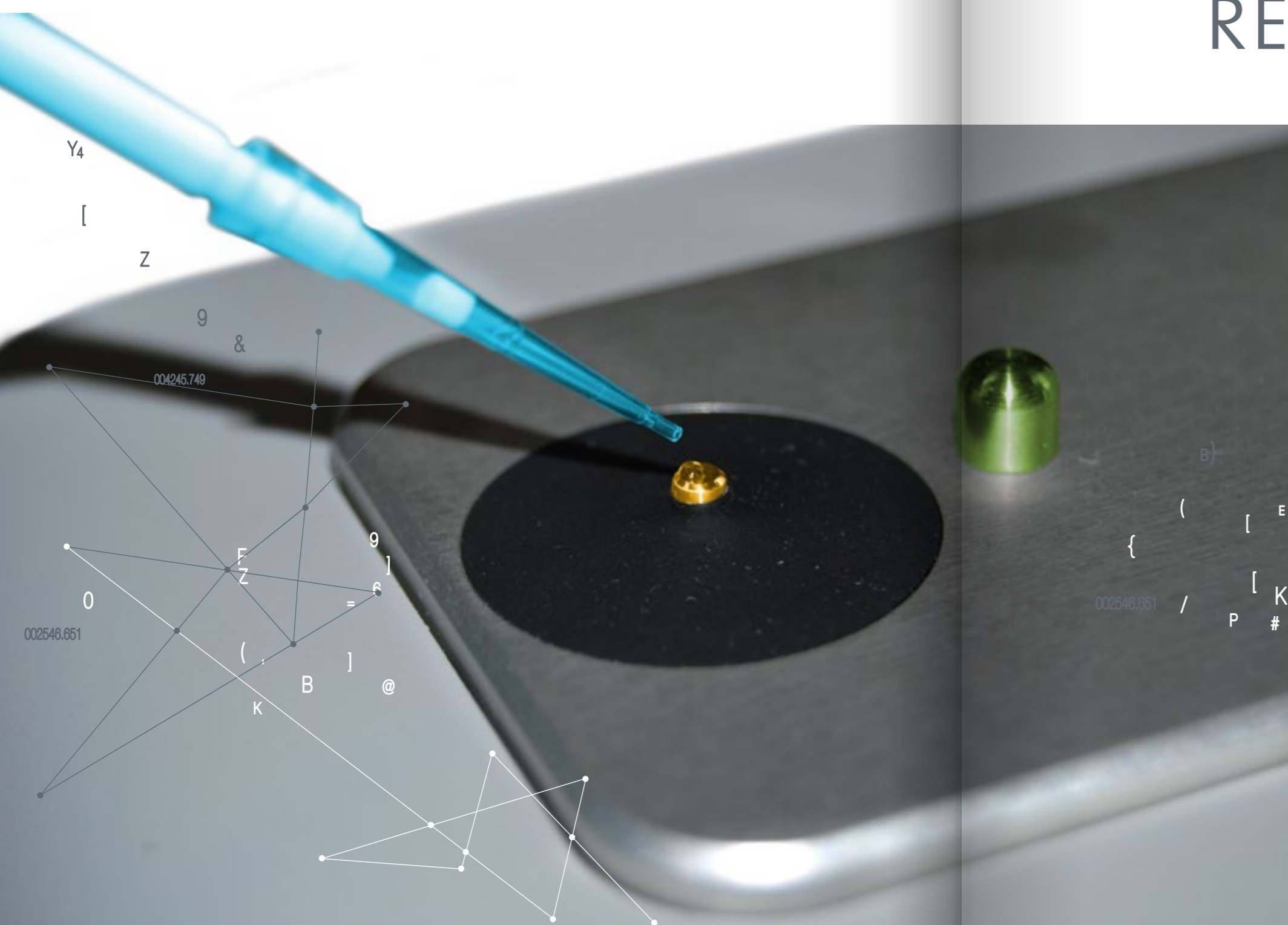
Pursuant to Act 3/2007 of 22 March on effective equality between women and men, ICRA and the Standing Committee on Equality have executed the Gender Equality Plan with the aim of establishing and developing policies that integrate equal treatment and opportunities between women and men.

The Standing Committee on Equality is a multidisciplinary team composed of 4 people from different areas and groups at ICRA. Questions or concerns on this matter can be addressed to the Standing Committee.

Standing Committee on Equality: **Marta Villagrasa, José L. Balcazar, Olga Corral and David López.**



# 03 RESEARCH AREAS



ICRA's Research Plan is structured in three main research areas, each with a mission and a vision aligned with those of ICRA.

The ICRA's areas and respective lines of research are as follows:

## ▶ AREA I RESOURCES AND ECOSYSTEMS

LINES

- A11 HYDROLOGICAL PROCESSES
- A12 LACUSTRINE AND RESERVOIR SYSTEMS
- A13 FLUVIAL SYSTEMS
- A14 MODELLING OF ECOSYSTEMS AND BASINS

## ▶ AREA II WATER QUALITY

LINES

- AII1 CHEMICAL CONTAMINATION OF WATER BODIES
- AII2 CONTAMINANTS IN WASTEWATER
- AII3 QUALITY AND MICROBIAL DIVERSITY
- AII4 ECOTOXICOLOGICAL RESPONSE OF BIOTA TO CONTAMINANTS

## ▶ AREA III TECHNOLOGIES AND EVALUATION

LINES

- AIII1 WATER SUPPLY AND ADVANCED TREATMENT
- AIII2 WASTEWATER TREATMENT, REUSE AND RESOURCE RECOVERY
- AIII3 MODELLING AND MANAGEMENT SYSTEMS
- AIII4 UNIT OPERATIONS



# AREA I RESOURCES AND ECOSYSTEMS

- ▷ AI1 HYDROLOGICAL PROCESSES
- ▷ AI2 LACUSTRINE AND RESERVOIR SYSTEMS
- ▷ AI3 FLUVIAL SYSTEMS
- ▷ AI4 MODELLING OF ECOSYSTEMS AND BASINS

## 19 RESEARCHERS IN THE AREA

- 1 research professor (UdG associated) and group leader  
**Sergi Sabater**
- 1 research professor (UdL associated)  
**Ramon J. Batalla**
- 1 research professor (UdG associated)  
**Josep Mas-Pla**
- 2 research scientists  
**Vicenç Acuña • Rafael Marcé**
- 1 postdoc researcher  
**Carme Font**
- 1 postdoc researcher  
**Núria Catalán**
- 1 postdoc researcher  
**Anna Freixa**
- 1 postdoc researcher  
**Albert Herrero**
- 1 postdoc researcher  
**Didac Jordà**
- 1 postdoc researcher  
**Julio Cesar Lopez**
- 4 predoctoral students  
**Miriam Colls • Ferran Romero • Elias Munthali • Juan David González**
- 4 research technicians  
**Maria Casellas • Daniel Augusto Mercado • Silvia Poblador • Carmen Gutierrez**



# AREA I RESOURCES AND ECOSYSTEMS

The activities of the Resources and Ecosystems (RiE) Area of ICRA have been conducted through a mixture of projects reaching their conclusion, the arrival of new research projects, and activities carried out with companies and public bodies. During this period, new post-docs joined the area to work on topics of river and stream ecology (Didac Jordà and Anna Freixa), while some graduate students working towards their PhDs or on research fellowships completed the team.

Research on the sustainable use of water resources in the face of global change was conducted through the continuation of the HIDSOS project, completing the setup of a monitoring network of suspended sediments and nutrients in a Pyrenean basin along with partnering several programmes conducted by the Catalan Water Agency (ACA) in both applied and scientific products.

The GLOBAQUA project has ended in 2018, and during this last year has involved the completion of several PhD theses as well as the contributions of several post-docs. The features of the GLOBAQUA project enhanced collaboration between the RiE research area and other areas at ICRA, in particular with the Water Quality area. This allowed expanding the multiple stressors approach to the implications of water chemistry as well as to understanding its links to the microbial world.

National projects such as SPACESTREAM have triggered intense research related to flow intermittency, carbon dynamics and ecosystem services. This project has provided relevant and refreshing perspectives on river ecosystems and hydrological basin dynamics regarding the implications for water resources quantity and quality from a perspective of global change. Another national project, PACE-IMPACT, has started in 2018 to look for the occurrence of pharmaceutical products in

selected hydro-geological environments, aiming to confirm the distribution patterns observed in the PERSIST project (2015-2017) as a basis for addressing such groundwater pollution cases.

ERANET projects in the ERA4CS call (CLIMALERT and XRM) have added a new perspective by linking global and regional climate models to ecological research. The two projects deal with climate services and how to mitigate the adverse effects of extreme climate events when their occurrence is known in advance (4-5 weeks).

Participation in European and international network projects has been also significant in 2018. At the European level, RiE researchers have continued their contribution to the COST Action SMIRRES, while the SNAP project and the GLEON network have expanded research networks beyond European borders.

All these projects have resulted in a better understanding of the effects of climate change on hydrological systems, whether surface water or groundwater. They depict and describe the complex relationships between stream intermittency and biodiversity, including the effect of emerging pollutants as ecological stressors. Interpretation of the results is geared towards assessing management strategies for such complex systems.



From left to right: Vicens Acuña, Josep Mas, Juan David González, Duygu Tolunay, Daniel Mercado, Núria Perujo, Didac Jordà, Joana Castellar, Carmen Gutiérrez, Elisabet Tornés, Julio Cesar López, Sergi Sabater, Carme Font, Rafael Marçè.

## ▶ LINE 1 HYDROLOGICAL PROCESSES

The team has continued the monitoring and modelling tasks relating to hydrology, sediment transport and nutrient loads in the River Noguera Pallaresa under the Research Contract 'Sustainability of Water Resources under Global Change' HIDSOS-IV, funded by ENDESA. The setup of a monitoring network for flow, sediment transport and nutrients has been completed and measurements continued in the River Noguera Pallaresa sub-basins. The data obtained is key to the calibration and validation of the TETIS® distributed model results, which has led to the implementation of global change scenarios in this large representative basin of the Southern Pyrenees. In addition, we re-opened a hydrometric station in the Vernagà basin

(Gavarres Massif) to obtain flow data in this intermittent stream with the objective of further characterisation of the possible effects of flow reduction and the increase in drought severity on the invertebrate community. The site has been re-equipped with water-stage sensors and time lapse cameras and it will also be used to test latest-generation flow sensors.

Dissemination on hydro-geomorphological processes in river basins has continued through the publication of papers, participation in national and international conferences and research leave which, together with the research previously described, foster efforts to transfer and internationalise the research of the whole Resources and Ecosystems Area.



## ▶ LINE 2 LACUSTRINE AND RESERVOIR SYSTEMS

The team has continued the monitoring and Tasks related to the WATExR project (JPI Climate ERA4CS) “Integration of climate seasonal prediction and ecosystem impact modelling for efficient adaptation of water resources management to increasing climate extreme events” have been conducted in 2018, aiming to achieve seasonal predictions for water in different case studies. In the case of the Sau Reservoir, which includes a seasonal climate prediction system, we created a hydrological model for the Ter River as well as a lake model for the Sau-Susqueda system. The prediction system was developed in beta version, ready to be used as a QGIS plug-in. All these progresses, as in all the other case studies around Europe, are conducted in a co-creation framework with the stakeholders such as the ATLL and the ACA in the field cases investigated by the ICRA team. Furthermore, ICRA has coordinated this project to reach cruising speed during 2018.

In the context of the MANTEL project (H2020 ITN), “Management of climatic extreme events in lakes and reservoirs for the protection of Ecosystem Services”, the ITN student Elias Munthali has settled on new methodologies to detect extreme events in historical water quality data series using historical records from the Sau Reservoir. He has also started analysis on how those events impact water quality in the reservoir. He additionally conducted a series of

experiments and field assessments on the impact of natural organic matter on the formation of disinfection by-products.

Moreover, we have started to investigate the fate of sedimentary carbon in lakes that dry out as a mission of the C-HydroChange project. The main task conducted in 2018 has been sampling of Lake Gallocanta (Spain), an expedition which required the development of new sampling equipment and strategies to deal with the lake’s dry bed. We have processed most of the data from this campaign and the statistical analysis will start in 2019; we expect the results from this field expedition be a turning point in our understanding of the fate of organic carbon in the sedimentary deposits of vanishing lakes.

Within these research lines, Rafel Marcé has acted as member of the Steering Committee of the Global Lakes Ecological Observatory Network (GLEON), the largest global network on lake ecology. GLEON’s main mission is to enhance collaborative research on lake ecology to solve the most pressing research needs with respect to global change. He was also the coordinator of the newly created “Lake Impact Sector” of the “Intersectoral Impact Model Intercomparison Project” (ISIMIP). ISIMIP is a multidisciplinary project aimed at simulating the impacts of climate change on all kind of sectors (agriculture, population, oceans, etc.)



## ▶ LINE 3 FLUVIAL SYSTEMS

During this reporting period, we have pursued our research lines on the effects of flow intermittency on (i) stream biota and biogeochemistry, (ii) the integration of ecosystem services in freshwater ecosystems management, and (iii) the effects and fate of emerging contaminants in freshwater ecosystems.

Most of the research regarding the effects of flow intermittency on freshwater ecosystems has been carried out within the framework of the GLOBAQUA project (603629-ENV-2013-6.2.1), the SPACESTREAM project (CGL2017-88640-C2-1-R) and the SMIRES COST Action (CA15113). Within the GLOBAQUA project, we have explored the response of algae (diatoms) and invertebrate communities in 11 Mediterranean streams which received treated or untreated urban sewage (Impact sites, I), whose composition and morphological anomalies were compared to upstream unaffected (Control, C) sites. The impact sites had high concentrations of ammonium, phosphorus and pharmaceutical compounds (antibiotics, analgesics and anti-inflammatory drugs), particularly in those receiving untreated sewage. The differences in the diatom assemblage composition between the C and I sites were largest in the sites receiving untreated sewage inputs or having low dilution capacity. Invertebrate abundance and total biomass increased in the impact sites because of wastewater inputs. These results indicate that the Mediterranean river systems facing hydrological stress are highly sensitive to chemical contamination, leading to the homogenisation of their biological communities.

The SPACESTREAM project started in January 2018, and in this initial phase we aimed to characterise the flow regime at selected sites within the Algars River basin. Samples on organic matter storage, transport and processing as well as dissolved nutrients and emerging contaminants have been collected so far. The work will continue to understand the dynamics of these materials associated to hydrological connection-disconnection, both longitudinally as well as in floodplain areas.

Within the SMIRES COST Action, we are leading one of the working groups of the action entitled eco-hydrology and ecosystem services. The first publication of the COST action is on design of environmental flows in intermittent streams and is also about to be submitted. The research line on the integration of ecosystem services in water management has continued during 2018 with the conclusion of the studies at the basin scale initiated in 2017. A publication summarising the effects of Global Change with and without implementing mitigation actions has been brought out. Furthermore, we have been actively working on the development of a socio-environmental process-based model at the sub-basin scale. This model is implemented in the Algars basin in the Ebro basin, where data on hydrology, climate, water uses, pollution, services demand and perception have been gathered. This work, although still underway, has allowed us to gain insights into the complex modelling of socio-environmental systems and we have submitted and achieved a research proposal in the most recent PRIMA call.

Finally, we have also pursued our research on both effects and fate of emerging contaminants in freshwater ecosystems, mainly in the GLOBAQUA and NANOTRANSFER projects. Regarding GLOBAQUA, we have performed a laboratory experiment assessing the effects of discharges of combined-sewer overflows (in collaboration with the Technologies and Evaluation Area) on biogeochemical processes, with special emphasis on GHG emissions. Furthermore, the analysis of the experiments carried out during 2017 has already led to the publication of several papers. The data modelling of the diclofenac inputs and fate is getting to a final stage of publication. The NANOTRANSFER project is aimed at understanding the effects on biofilms of carbon nanomaterials, solely or in combination with other contaminants. Results have been already published describing the findings of several experiments on the interaction between these nanomaterials and other emerging contaminants such as triclosan.



## ▶ LINE 4 MODELLING OF ECOSYSTEMS AND BASINS

Research in this line has been conducted under the IMPACT project, which looks for the occurrence of pharmaceuticals in groundwater. This project includes the study of several regional-scale cases in order to reveal the main processes that govern the movement of these emerging contaminants in the subsurface. The project started with the sampling of several natural springs that represent an integrated sample of what happens in the uppermost surface. Meanwhile, field work has been conducted to select representative sampling points (wells) in two different aquifers with distinct hydro-geological settings. This project entails collaboration with researchers in the Water Quality area.

As a result of a former project (PERSIST), ICRA researchers have contributed to the “Final Evaluation Meeting of the Water JPI Pilot Call Projects” and the “Water JPI Knowledge Hub on Emerging Contaminants”, held in Helsinki, Finland, in June 2018 which wrote a Policy Brief to advise European agencies on the occurrence of emerging contaminants in the environment.

An international partnership has been established with the University of Pavia in Italy on the study of nitrate evolution in a part of the Lombardy aquifer. This area assesses the build-up of a numerical groundwater flow and solute transport model for this regional study that will later on be used to improve governance by simulating the scenarios that result from policy decisions.



### TECHNOLOGY TRANSFER

**SABATER, S., BATALLA, R.J.**, Sostenibilidad de recursos hídricos bajo el cambio global (HID-SOS-IV). ENDESA. 2017-8.

### AI- PHD DISSERTATIONS

**LADISLAV MANDARIC** (Universitat de Girona). “Transport, distribution, and the fate of emerging contaminants in wastewater receiving rivers under multiple stress conditions”. Supervised by Mira Petrovic and Sergi Sabater.

### VISITING SCIENTISTS

**ALO LAAS** – Visiting Scientist of Estonian University of Life Sciences (January-April 2018)

**JORDI RENE MOR** – PhD Student of the Fundació Bosch i Gimpera (FBG) (January-December 2018)

**ELISABETH TORNES** – Visiting Scientist of the Universitat de Girona (January-December 2018)

**JORGE LEON** – Visiting Scientist of the Universidad Católica de la Santísima Concepción (October 2018)

### VISITING STUDENTS

**ARIANNA MUSACCHIO** – Internship Student of the Università Degli Studi Di Pavia (April-December 2018)

**HASNA CHABACA** - Internship Student of Chadli Benjedid El Tarf University (October 2018)

**MARGARET ARMSTRONG** – Internship Student of the Netherlands Institute of Ecology (September-November 2018)



# AREA II WATER QUALITY AREA

- ▶ AII1 CHEMICAL CONTAMINATION OF WATER BODIES
- ▶ AII2 CONTAMINANTS IN WASTEWATER
- ▶ AII3 QUALITY AND MICROBIAL DIVERSITY
- ▶ AII4 ECOTOXICOLOGICAL RESPONSE OF BIOTA TO CONTAMINANTS

## 22 RESEARCHERS IN THE AREA

- 1 ICREA research professor and group leader  
**Mira Petrovic**
- 1 research professor (CSIC associated)  
**Damià Barceló**
- 1 research professor (UdG associated)  
**Carles Borrego**
- 1 research scientist  
**José Luis Balcázar**
- 1 research scientist (Ramon y Cajal)  
**Sara Rodríguez-Mozaz**
- 1 research scientist (Ramon y Cajal and IIF)  
**María Jose Farre**
- 4 postdoc researchers  
**Lucia Helena Moreira • Pablo Gago • Meritxell Gros • Josep Angel Sanchis**
- 8 predoctoral researchers  
**Mira Celic • Adrian Jaen • Ladislav Mandaric • Albert Serra • Jessica Subirats • Yaroslav Verkh • Jose M. Albahaca • Jose M. Castaño**
- 3 research technicians  
**Nuria Caceres • Mireia Nuñez • Mireia Fillol**
- 1 RDI technician  
**Miyako Nitta**

# AREA II WATER QUALITY

Research in the Water Quality area follows three main lines of investigation, namely: i) Chemical contamination of water bodies, ii) Pollution in wastewater, and iii) Effects of chemical and environmental stressors of aquatic microbial communities.

The main results and activities of these three research lines carried out in 2018 are summarised below.



From left to right: Damià Barceló, José María Castaño, Mira Petrovic, José Luis Balcázar, Mira Celic, Albert Serra, Leonardo Moura (Visiting Student), Adrián Jaén, Lucía Helena Santos, Núria Cácers, Josep Sanchis, Elissavet Kassotaki, Pablo Gago, Maria José Farré, Sara Rodríguez, Carles Borrego, Josiel José Da Silva (Visiting Student), Elisa García.

## ▶ LINE 1 CHEMICAL CONTAMINATION OF WATER BODIES

### Evaluation of alternative treatment strategies for the elimination of emerging pollutants from wastewater

Fungal biodegradation has become a promising approach among wastewater treatment technologies to remove emerging micropollutants due to the nonspecific ligninolytic enzymatic system of fungi, which targets the degradation

of both biological and xenobiotic compounds. The H2PHARMA project “Fungi, algae and bacteria degrading pharmaceuticals. Hospital effluent treatment by fungi” (MINECO-CTM2013-48545-C2-2-R) proposes the development of a treatment process for hospital wastewater using ligninolytic fungi. During 2018 we have tested the efficiency of these treatment technologies alone and also coupled to advanced oxidation pro-

cesses (AOPs) for the removal of emerging pollutants in hospital wastewater. Special attention was paid to the study of generation of transformation products from target pollutants such as benzotriazoles and pharmaceuticals (including antibiotics) along with treatment processes and their potential environmental impact. The performance of other biodegrading microorganisms such as algae was also evaluated for the removal of antibiotics from wastewater. These eco-friendly systems open up the possibility of reuse by industry or agriculture of effluent treated with these alternative treatments.

### Bioaccumulation of emerging pollutants in aquatic organisms. Impact on public health

The impact of the contaminants in the aquatic environment can be evaluated by assessing selected toxicological effects and/or by measuring the bioaccumulation of the target pollutants in aquatic organisms. During 2018, and as a follow-up of the project ECsafeSEAFOOD “Priority Environmental Contaminants in Seafood: safety assessment, impact and public perception” (FP7-KBBE-2012-6-singlestage; 311820), we have continued our collaboration with Antonio Marques’s group at the Portuguese Institute for the Sea and Atmosphere (IPMA) in Lisbon. We studied the effects of climate change related stressors (water acidification and temperature increase) on the bioconcentration, metabolisation and depuration of emerging pollutants such as pharmaceuticals and endocrine disruptors in both mussel species (*Mytilus galloprovincialis*) and fish (juvenile meagre; *Argyrosomus regius*). These marine species were exposed to selected emerging pollutants under laboratory conditions. In addition, the presence and levels of a wide range of emerging pollutants were evaluated in commercially available seafood in the European Union market in terms of the dietary exposure of humans to these compounds through seafood consumption. A sampling survey of different species of seafood from 11 European countries was undertaken. The effect of cooking on contaminant levels was also investigated.

### Evaluation of the effect of microplastics and nanoparticles in the accumulation of organic micropollutants in river biofilm

New emerging pollutants such as microplastics and nanoparticles can act as carriers of organic

contaminants and alter their impact in aquatic organisms. In the project NANOTRANSFER, “Transfer of carbon based manufactured nanomaterials in the aquatic environment: An assessment of their fate and effects, bioaccumulation, food web transfer, Trojan horse effects, and green applications” (ERA SIINN PCIN-2015-182-Co2-02) mesocosm experiments were launched with aquatic macroinvertebrates and biofilm as model organisms. River biofilms are in close contact with the water column and streams and have been used in ecotoxicological studies to evaluate the impact of selected stressors in freshwater ecosystems. The impact of carbon nanoparticles fullerenes on bioaccumulation and biotransformation of selected contaminants (venlafaxine, diuron and triclosan) in river biofilms was assessed during 2018. In addition, the project PLAS-MED “Microplastics and micropollutants in the Mediterranean coast: Toxicity and impact in the environment and human health” (MINECO CTM2017-89701-C3-2-R) has started in 2018 with the aim of studying the role of microplastics in the transference, bioaccumulation and toxicity of pharmaceuticals and other emerging pollutants in aquatic organisms. Besides laboratory experiments, a monitoring campaign in coastal areas in Spain (Ebro estuary and in the Mar Menor lagoon in Murcia) was carried out in July 2018, where water, sediments and biota were collected for the assessment of the presence of selected emerging pollutants and microplastics. A metabolomics approach, a powerful tool to better evaluate the ecotoxicological response of aquatic organisms in areas impaired by the presence of such contaminants, was applied to mesocosm biological samples including fluvial biofilm.

### Study of occurrence and fate of disinfection by-products and their precursors in drinking and recycled water

Disinfection by-products (DBPs) and their precursors are studied in the project NDMA-Predict (How to predict and minimise NDMA formation in potable and recycled water through advanced analytical techniques) funded by AEI-MICIU. The main objective of this project is to investigate N-Nitrosodimethylamine (NDMA) precursors with advanced high-resolution mass spectrometry techniques. The first part of this project has been done with the collaboration of researchers from the RiE area and organic matter characterisation techniques have been used to statistically link the potential of NDMA for-



mation with areas of Van Krevelen diagrams obtained with Orbitrap. First results show that the molecular composition of dissolved organic matter across specific drinking water reservoirs is correlated with NDMA formation potential. In particular, we found that NDMA formation potential is associated with compounds with high hydrogen saturation, corresponding also

to reservoirs with higher background nutrient concentrations and wastewater indicators

Other studies carried out within this topic included the study of NDMA degradation with UV/peroxodisulphate (AEI-MICIU project TRICERATOPS) and the characterisation and quantification of precursors of DBPs in algae-impacted natural waters (ITN-EJD MANTEL).

## ▶ LINE 2 CONTAMINANTS IN WASTEWATER

In 2018, the main activities of this research line were:

### Evaluation of wastewater treatment processes using advanced methodologies for comprehensive characterisation of dissolved organic matter (DOM) in wastewater

Despite many methodologies being developed to evaluate contaminants in wastewater, the detection of thousands of potentially dangerous DOM constituents and their transformation products (TPs) in wastewater treatment remains a challenge. Among methods applied is mass spectrometry (MS) with a distinctive ability to identify small amounts of organic chemicals from increasingly complex mixtures, thereby providing a large amount of information on wastewater DOM and micro-contaminants of interest. Within the H2020 MSCA ITN-EID project **TreatREC** (*Interdisciplinary concepts for municipal wastewater treatment and resource recovery. Tackling future challenges*), we have developed and tested a method to track transformations of wastewater DOM using non-targeted analysis of liquid chromatography-high-resolution mass spectrometry (LC-HRMS) data that conceptually prioritises detection of anthropogenic compounds. The method was applied to quadrupole-time of flight (QTOF) and Orbitrap HRMS data to test the robustness and influence of instrumental setup on analytical conclusions. Orbitrap outperformed in terms of accuracy and higher resolving power, for example showing a higher amount of detected molecular features and the rate of molecular formula assignment. QTOF showed advantages

in including a subset of high molecular weight features due to the stronger stability of resolving power of QTOF at higher m/z.

Additional suspect screening analysis revealed the transformation of chemicals in wastewater by looking for particular micro-pollutants and their confirmed as well as tentative TPs to supplement the non-targeted analysis performed. The screening method was applied to a real wastewater system with secondary biological treatment and tertiary treatment consisting of sand filtration, UV-treatment and chlorination. Moreover, a new granular bio-activated carbon-ultrafiltration (BAC-UF) system was used, where the suspect screening confirmed high removal of chemicals in the first months of the reactor runtime while the efficiency dropped in the later months due to BAC filter saturation.

Within the 2020 MSCA EF project **SMART-WORKFLOW** (*Development of a smart workflow based on high resolution mass spectrometry for the assessment of the performance of wastewater treatment technologies*) we focussed on integrating the latest advances in high resolution mass spectrometry (HRMS) and statistical analysis of data to develop and optimise a smart methodology (workflow) for the assessment of the overall efficiency of wastewater treatment using different technological approaches while focusing on innovative treatments. The workflow generated is a procedural sequence for data acquisition, data processing and data mining and it will be applicable to both already-known and new wastewater treatments, providing a rapid assessment on their performance regarding the removal of polar organic compounds and generated transformation products (TPs).

During 2018 the research has focused on the development of new computational tools that allow the transformation of raw HRMS data into peak lists and molecular formulas. These tools are being used to evaluate changes at a molecular level in various innovative water treatments based on advanced oxidation processes. The potential addition of sulphur in the transformation products generated, the addition of halogens and the general oxidation state are being evaluated in collaboration with researchers from the TiA area. Changes at the molecular level are also being evaluated in the treatment of contaminated soils by electrochemical treatment in collaboration with researchers from the Swedish University of Agricultural Science.

### Study of transport, distribution and fate of wastewater-derived emerging contaminants

The group was involved in the FP7 project **GLOBAQUA** (*Managing the effects of multiple stressors on aquatic ecosystems under water scarcity*) that focuses on water scarcity issues in the European context by studying the occurrence, distribution and transport of wastewater-derived contaminants in the aquatic environment.

The contamination patterns and fate of pharmaceutically active compounds (PhACs) were investigated in the Evrotas River (Southern Greece). This is a temporary river with differing levels of water stress and water quality impairment in a number of its reaches. Discharge of urban wastewater has been determined as the main source of pollution, with PhACs, nutrients and other physicochemical parameters considerably increasing downstream of the wastewater treatment plant (WWTP) of Sparta city. Due to the pronounced hydrological variation of the Evrotas River, generally the highest concentrations of PhACs have been detected during low flow conditions. Simultaneously, low flow resulted in increased water travel time and consequently longer residence time that accounted for the higher attenuation of most PhACs. The average decrease in total concentration of PhACs within the studied water body segment (downstream of Sparta city) increased from 22%

in conditions of moderate stream flow to 77% in conditions of low flow. The PhACs with the highest average concentration decrease throughout the sampling campaigns were hydrochlorothiazide followed by sotalol, carbamazepine, valsartan and naproxen.

### Analysis and evaluation of fate and environmental risks of organic fertilisers reuse in agriculture

This research is conducted as part of the H2020-MSCA-IF project **RESOURCE** (*Groundwater quality assessment in areas with intensive livestock: is manure recycling a major source of pollution and dissemination of antibiotic resistance genes?*). This project is done in collaboration with researchers in the RiE area and the Microbial Diversity group at ICRA and aims at broadening knowledge about the role of animal manure recycling as a major source of groundwater pollution in agricultural areas by using two approaches: (i) analysing selected multiple-class veterinary antibiotics and antibiotic resistance genes (ARGs) conferring resistance to the main antibiotic classes and (ii) identifying the molecular profile of manure-impacted groundwater bodies through the characterisation of dissolved organic matter (DOM) using high-resolution mass spectrometry (HRMS). Research conducted in 2018 has focused on the development of methodologies to determine a wide range of veterinary antibiotics and ARGs in groundwater samples and on the design of a streamlined workflow to process HRMS data for DOM characterisation. We have also started ongoing comprehensive monitoring of selected manure-impacted groundwater bodies located in hot-spot sites in Catalonia and used as drinking water sources. Preliminary results show the occurrence of tetracycline and sulphonamide antibiotics at concentrations ranging from ng L<sup>-1</sup> to low µg L<sup>-1</sup> levels, with strong variability between sampling seasons. ARGs conferring resistance to the detected antibiotic classes have also been identified. The outcomes of this study will be highly valuable to assess the current status of groundwater bodies and will contribute in preventing serious environmental and human health issues.



## ▶ LINE 3 QUALITY AND MICROBIAL DIVERSITY

### Effects of anthropogenic pollution on the environmental resistome

Antibiotic resistance is a major and growing health concern and surveillance of the causes and consequences of its spread should include the links among human, animal and environmental health (One Health approach). One of our main goals is therefore to evaluate the impact of wastewater discharges on the abundance, diversity and potential dissemination of antibiotic resistance genes (ARGs) in aquatic systems. By using a combination of molecular and bioinformatic approaches we explored and compared the resistome (the pool of ARGs in a given habitat) and the mobilome (the pool of genes related to mobile genetic elements) in water samples collected both upstream and downstream from the discharge point of an urban wastewater treatment plant into the River Ter (Girona). The results, which have been published in *Environmental Pollution*, confirmed that chronic discharges of treated wastewater severely impact the river resistome affecting not only the abundance and diversity of ARGs but also their potential dissemination by enriching the river mobilome in a wide variety of mobile genetic elements such as transposases, integron integrases and insertion sequence common region elements (Lekunberri et al., 2018, *Env. Pollut.* 234: 538-542).

In 2018 we have also collaborated with European research groups to assess whether the abovementioned impacts were relevant in other European rivers and if the extent of such impacts was dependent on the type of pollution (*i.e.* urban or hospital wastewater). In a collaboration with researchers from the Ecologie des Systemes Aquatiques group at the Université Libre de Bruxelles (Belgium) we obtained sound evidence that discharges of urban wastewater treatment plants in the River Zenne severely alter the composition of free-living and particle-attached bacterial communities and the abundance of antibiotic resistance genes (ARGs) in both bacterial fractions. These results have been published in three complementary papers that reinforce the idea that chronic contamination of surface water by treated wastewater is a key factor in the spread of antibiotic resistance in the aquatic environment, including the

dissemination of genes conferring resistance to last-resort antibiotics such as carbapenems (Proia et al., 2018, *J. Hazard. Mat.* 358: 33-43; Proia et al., 2018, *Chemosphere* 206: 70-82; Proia et al., 2018, *Sci. Total Environ.* 628-629: 453-466).

In addition, we have collaborated with the Microbial Ecology group at the *Water Research Institute* (CNR-IRSA) in Verbania (Italy) to investigate the effect of reclaimed water on a bacterial community collected in the non-impacted Lake Mercurago (Verbania). In this case, we used a chemostat system to mimic the growth conditions of freshwater bacteria at the source lake. We assessed the impact of two treatments, namely: a first one consisting of an equal mixture of reclaimed water and source water (1:1), and a second one consisting of the use of this mixture supplemented with 5 µg l<sup>-1</sup> of cefotaxime (a third generation cephalosporine). Results confirmed that both treatments stimulated microbial growth in comparison to control conditions (lake water) due to nutrients carried over by the reclaimed water. Besides, both treatments caused a significant increase in the abundance of the genes *tetW* (resistance to tetracyclines), *intH* (proxy for anthropogenic pollution and gene mobilisation) and *arsB* and *czcA* (both conferring resistance to heavy metals). Unexpectedly, incorporation of cefotaxime in the feeding medium did not cause an increment in the concentration of genes conferring resistance to β-lactam antibiotics such as cefotaxime (e.g. *bla*<sub>CTX-M</sub>, *bla*<sub>OXA</sub> and *bla*<sub>KPC</sub>), which were always below the detection limit of the qPCR assay used. On the other hand, exposition of bacterial communities to reclaimed water caused enrichment in the relative abundance of *Acinetobacter* and *Pseudomonas*, two bacterial genera encompassing multidrug resistant opportunistic pathogens. This collaboration was funded through a grant by the Cost Action ES1403-NEREUS to Dr Jèssica Subirats (*Short Term Scientific Mission grant*, Ref. ES1403-36046).

### The sewer resistome and its response to chemical treatments

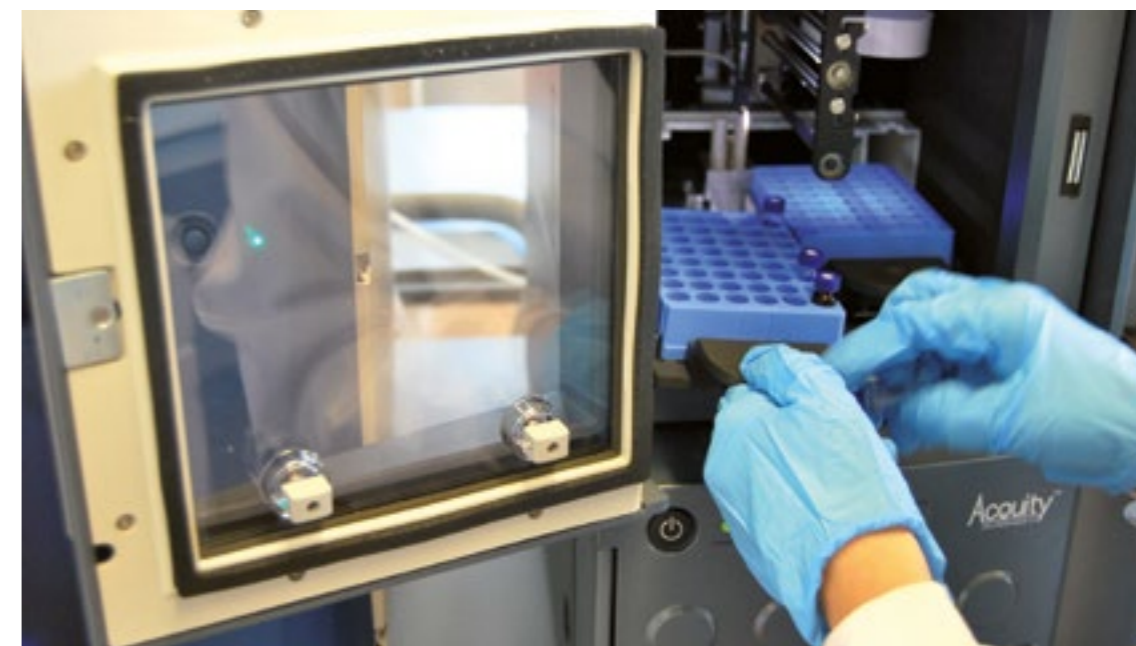
In 2018, most of our efforts have focused on the assessment of the effects that chemical treatments routinely applied to reduce sulphide and methane emissions from sewers have on the

abundance and dissemination of antibiotic resistant bacteria (ARB) and their ARGs. This is the main goal of the **SEWAGENE project** (*Accumulation, Spread and Removal of Antibiotic Resistance in Sewer Systems*, Ref. CTM2016-75653-R) funded by the Spanish Ministry of Economy and Competitiveness.

The production and emission of sulphide from sewer systems is a serious problem to both sewer managers (corrosion of sewer pipes) and public health (odour problems and accumulation of hazardous compounds). To mitigate sulphide emissions, sewer managers apply chemical treatments (mainly nitrate) to oxidise sulphide to elemental sulphur and to reduce the activity of sulphate-reducing bacteria. These treatments cause oxidative stress on the sewer microbiota that may have undesired side effects. One such effect is the triggering of stress responses by sewer microorganisms that alter gene expression and mobilisation. Particularly, alteration of expression levels of ARGs and stimulation of horizontal gene transfer among sewage microorganisms are of special concern considering that raw sewage is a hotspot for ARB and ARGs. We thus investigated variations in the expression profile of several ARGs and genes related with mobile genetic elements before and after nitrate dosage, in particular differences in the abundance of gene transcripts of *recA* (a stress-response gene), *intH* and *ISCR-1* (proxies for gene mobilisation), *sulH* (encoding resistance to sulphenamides), *bla*<sub>KPC</sub> (encoding resistance to

carbapenems), *tetW* (encoding resistance to tetracyclines) and *qnrS* (encoding resistance to fluoroquinolones). Results confirmed that the addition of nitrate caused a drop in the sulphide concentration but significantly altered the expression profile of some of the target genes. Specifically, the nitrate treatment caused an overexpression of genes *intH*, *sulH* and *qnrS* and an underexpression of genes *ISCR-1* and *tetW*. This alteration in gene expression can be attributed to a stress response to the oxidative stress applied since *recA* transcripts (a gene that regulates the response to stress condition through the activation of the SOS regulon) could only be quantified in samples collected after the addition of nitrate. The nitrate treatment also caused an increase in the abundance of bacteria resistant to sulphamethoxazole, colistin, cefotaxime and ciprofloxacin. Besides, we measured a concomitant increase in the relative abundance of genes identified as ARGs in metagenomes from sewer microbial communities exposed to nitrate when compared to those under control conditions.

To corroborate these results at mid- and full-scale, we assembled a laboratory pilot plant consisting of a mid-scale sewer pipe in which to optimise the removal of ARB from raw sewage and to reduce the accumulation of ARGs in sewer pipes, and we sampled a full-scale sewer in L'Escala (Alt Empordà) before and after the dosage of nitrate by sewer managers. Results from these complementary approaches are in progress.





## TECHNOLOGY TRANSFER

During 2018, the collaboration with **Canal de Isabel II** continued with a technology transfer project to analyze N-nitrosodimethylamine (NDMA) in potable water.

Likewise, the group has also continued successful collaboration with **Thermo Scientific**, developing methodologies for the analysis of NDMA with the latest equipment (GC-Orbitrap and TSQ 9000™ GC). This collaboration ended in July with the presentation of the webinar: Lamb A., and Farré, M.J. webinar Unparalleled Performance of Advanced Electron Ionization GC-MS / MS technology for the determination of nitrosamines in drinking water.

## All- PHD DISSERTATIONS

**JÈSSICA SUBIRATS MEDINA.** *"Influence of anthropogenic pollution on the prevalence, maintenance and spread of antibiotic resistance in aquatic microbial communities"*. University of Girona, Supervisors: Carles Borrego and José Luis Balcázar. July 24th, 2018. CUM LAUDE.

**SERGI COMPTE PORT.** *"Factors affecting the distribution, abundance and diversity of uncultured archaeal groups in freshwater sediments"*. University of Girona, Supervisor: Carles Borrego. July 3rd, 2018. CUM LAUDE.

**LADISLAV MANDARIC.** *"Transport, distribution, and the fate of emerging contaminants in wastewater receiving rivers under multiple stress conditions"*, University of Girona, Supervisors: Mira Petrovic and Sergi Sabater, Oct 24th 2018. CUM LAUDE

## VISITING SCIENTISTS

**PROF. LIDIJA CURKOVIC,** Faculty of Mechanical Engineering and Naval Architecture, Zagreb, Croatia (June-July 2018).

**SUSANA BRICEÑO GUEVARA,** Centro de Investigación en Contaminación Ambiental de la Universidad de Costa Rica (October-December 2018).

**MIRTA CIZMIC.** University of Zagreb (June-July 2018).

**ANA PREVISIC.** University of Zagreb (September-December 2018).

**MARKO ROZMAN.** Ruder Boskovic Institute (September-December 2018).

## VISITING STUDENTS

**JOSIEL JOSÉ DA SILVA,** PhD student at Universidade Estadual Paulista (UNESP) in Brazil (November-December 2018).

**MARILIA MOURA DE SALLES.** Internship in Tiradentes University (January-November 2018).

**LEONARDO MOURA.** Internship in the Federal University of Rio de Janeiro (November-December 2018).

**CYNTHIA BERNAL.** Universidad Nacional de Asunción. Research stays in the context of a collaboration with Prof. Juan Francisco Facetti (Facultad de Ingeniería, Universidad Nacional de Asunción, Paraguay) (January-February 2018).

**MARION MATHIEU CHERRIER.** Ecole de Biologie Industrielle, student internship (June-September 2018).

**NOELIA LÓPEZ VIDAL.** University of Girona. Research stay as part of the Master's degree in Molecular Biology and Biomedicine at the University of Girona (January-July 2018).

**MARC CASTAÑO.** University of Girona. Research stay as part of the Master's degree in Applied Chromatographic Techniques of the University of Girona (March-June 2018).

**JOSÉ LUCAS MARTINS VIANA.** Research stay as part of his Master's degree at the Universidade Federal do Maranhão e del Instituto Federal de Educação, Ciência e Tecnologia do Maranhão, Brazil (April-July 2018).

**CRISTINA TURÓN.** Internship as part of the Chemistry degree of the University of Girona (January-July 2018).

**MARTA PARDO MEDRANO.** Internship as part of the Biotechnology Degree of the University of Girona (January-June 2018).

**MARC DANTI RAMOS.** Internship as part of the Biotechnology Degree of the University of Girona (January-June 2018).

**ANNA TURÓN BAS.** Internship as part of the Biology Degree of the University of Girona (June-December 2018).





# AREA III TECHNOLOGIES AND EVALUATION

- ▷ AIII1 WATER SUPPLY AND ADVANCED TREATMENT
- ▷ AIII2 WASTEWATER TREATMENT, REUSE AND RESOURCE RECOVERY
- ▷ AIII3 MODELLING AND MANAGEMENT SYSTEMS
- ▷ AIII4 UNIT OPERATIONS

## 31 RESEARCHERS IN THE AREA

- 1 research professor (UdG associated) and group leader  
**Ignasi Rodríguez-Roda**
- 1 research professor (UdG associated)  
**Joaquim Comas**
- 1 ICREA research professor  
**Wolfgang Gernjak**
- 1 ICREA research professor  
**Jelena Radjenovic**
- 1 research scientist  
**Maite Pijuan**
- 1 research scientist (Ramon y Cajal)  
**Gianluigi Buttiglieri**
- 1 research scientist (Ramon y Cajal)  
**Lluís Corominas**
- 6 postdoc researchers  
**Luis Miguel Baptista • Luca Fortunato • Oriol Gutiérrez • Ibrahim Erdem Irtem • Mark Santana • Inmaculada Velo**
- 10 predoctoral researchers  
**Federico Ferrari • Pau Gimeno • Elissavet Kassotaki • Anna Ribera • Marc Sauchelli • Natalia Sergienko • Lucia Gusmaroli • Aleksandra Kaminska • Esther Mendoza • Florjan Norra**
- 8 research technicians  
**Lluís Bosch • Silvia Busquets • Adrià Riu • Laia Bocanegra • Anastasya Kravtchenko • Dante Maschio • Nikoletta Tsiarta • Anna Valls**



# AREA III TECHNOLOGIES AND EVALUATION

As in previous years, the results of the Technology and Evaluation area demonstrate the excellent work performed. As can be appreciated in the description of the individual research lines, the outcomes are excellent not only regarding research but also in the training of young researchers. Knowledge and technology transfer has also been carried out. This was possible thanks to the outstanding effort by all young and senior researchers, including all students and technicians contributing to the different R&D projects carried out in 2018.

Further to individual achievements, we highlight the recognition and funding received as a consolidated research group (2107024\_SGR17-19\_ICRA-TECH) within the Catalan research system, formed by 14 researchers (including two seconded professors from the University of Girona, two ICREA research professors, and three Ramon y Cajal fellows, seven staff scientists and postdoctoral researchers).

This recognition fostered increased awareness of our potential as a research group, boosting internal and external alliances, promoting capture of national and international resources and talent, enhancing our participation and visibility in different networks in the water sector locally (in Girona, with the Water Campus at the University of Girona and the City Council), regionally (with the RIS3CAT Water Community, Projects for Territorial Specialisation and Competitiveness (PECTs), Catalan Water Partnership (CWP), Associació d'Amics de l'Aigua), nationally (Mesa Española de Tratamiento de Aguas (META), the Spanish Technological Platform for Water (PTEA)), and at the European level (WssTP, The European Water Platform, COST Action Circular Cities, COST Action NEREUS).

This increased presence and prominence in this innovation ecosystem of the water sector formed by companies, public administrations and research entities has enabled us to form and join powerful consortia that have spawned successful project proposals, where in many cases ICRA contributed to the consortium's leadership. It has also improved our connections

to many well-known research groups leading to short stays, seminars, participation in thesis committees of international researchers etc, from which the whole area benefitted, senior and junior researchers alike. These visits also assisted in the dissemination of ICRA's latest research efforts beyond traditional means such as publications.

In 2018, we have also increased our presence on social media such as Twitter, spreading news of our R&D and KTT activities hot off the press via personal and institutional accounts (@lcratech). We believe that ICRA is a place to be proud of and the many hours that we dedicate to it should not only be reflected in traditional science indicators but should also facilitate personal growth and contacts lasting beyond the time we spend working at ICRA. Hence, we have also worked on team building with cross-cutting training and social activities to break out from our daily routines from time to time, leading to increased cross-fertilisation among projects, research lines and also with other research areas at ICRA.

Below we present a short summary of the activities carried out within the scope of each research line, each of them by itself being absolutely cross-cutting. As we explained in the last annual report, they mean we are one of a handful of national research groups that carries out research on the whole urban water cycle, including drinking and wastewater, sewer and distribution systems, fundamental process knowledge regarding transport and fate of contamination in biological and physical-chemical treatment technologies, modelling of processes and systems, most especially electrochemical treatments and resource recovery, etc. We also analyse the application of these technologies in the context of cities and selected industry sectors (such as tourism), fostering the implementation of the circular economy, nature-based solutions and closure of the water loop. In 2019, we will be commencing projects on the digitalisation of the water sector, with the main objectives being related to sustainable sanitation, access to safe drinking water and the study of the water-energy-health nexus.



From left to right: Luis Miguel Baptista, Paul Lant (Visiting Scientist), Lluís Coromines, Laura Castañares, Giannis Florjan Norra, Joaquim Comas, Silvia Busquets, Gianluigi Buttiglieri, Nùria Cáceres, Aleksandra Kaminska, Nick Duinslaeger, Esther Mendoza, Wolfgang Gernjak, Soraya Zahedi, Marc Castaño, Natalia Sergienko, Jelena Radjenovic, Ignasi Rodríguez- Roda, Nikoletta Tsiarta, Maria José Farré, Michelle Ponzelli.

## ▶ LINE 1 WATER SUPPLY AND ADVANCED TREATMENT

This research line has two overarching themes: the development of novel processes and treatment trains mostly focused on physical-chemical treatments, and water quality management in these processes. These strategies are applied to increase water supply diversity by amending the quality of challenging traditional and alternative water sources contaminated mainly with organic pollutants but also inorganic ones such as nitrate.

The recently commenced ERC Starting Grant *ELECTRON4water* led by ICREA professor Jelena Radjenovic develops fundamental science and materials for electrochemical treatment technology for the following applications:

- Electrochemical removal of poly- and perfluoroalkyl substances (PFASs) from water based on flow-through, porous anode ma-

terials with carbon and metal-based nanostructured coatings. These high surface area materials enhance direct electrolysis of PFASs into innocuous by-products (e.g., CO<sub>2</sub>, HF). This work is being conducted by José Miguel Albahaca Oliva (PhD student) and Luis Pires (postdoc fellow).

- Electrocatalytic denitrification for groundwater treatment using reduced graphene oxide (RGO) and N/S-doped RGO coated cathodes. The objective is the development of a material capable of selective reduction of nitrate to nitrogen gas (N<sub>2</sub>) and is conducted in the scope of the PhD thesis of Aleksandra Kaminska. It was initiated by Dr Erdem Irtem.
- Removal of persistent organic contaminants from wastewater by a packed-bed electrochemical reactor based on RGO, MnOx and

RGO/MnOx coatings. By using granular material with conductive and/or catalytic coating placed inside the electric field, the reactor's performance in the elimination of persistent contaminants from water can be drastically enhanced compared to a conventional plate-and-frame reactor. This work is being conducted in the scope of the PhD thesis of Gianni Florjan Norra.

- Synthesis and evaluation of novel, porous flow-through graphene and MXene-based materials for anodic and cathodic degradation of contaminants. This work is being carried out by Dr Luis Pires.

Furthermore, in 2018 the MINECO-funded Triceratops project led by ICREA Professor Wolfgang Gernjak ended, in which post-doctoral fellow Inmaculada Velo Gala investigated novel process configurations for UV-based Advanced Oxidation Processes. Specifically, we investigated the impact of using alternative oxidants such as hypochlorite or persulphate. For example, we demonstrated that substituting hydrogen peroxide using persulphate instead allows us to reduce energy consumption and reactor size by a factor of 4 in the abatement of N-nitrosomethylamine (NDMA) in the post-treatment of reverse osmosis permeates.

A PhD is being carried out in collaboration with

Wetsus in the Netherlands ([www.wetusus.nl](http://www.wetusus.nl)), where PhD student Nimmy Kovoov George (principal supervisor, Wolfgang Gernjak, ICRA) aims to develop novel AOPs making use of the 185 nm and the 254 nm component simultaneously emitted by low pressure mercury lamps. Besides targeting an understanding of the chemistry of the process, this PhD project has a strong emphasis on computational fluid design modelling and reactor design as well.

The PhD thesis of Marc Sauchelli researches the impact of the draw solute and reverse solute flux in forward osmosis (FO) for mass transport of contaminants through the membrane. A second aspect concerns fundamental research regarding fouling in FO, specifically how pressure and transmembrane flux govern cake build-up.

The water quality and supply management aspects within the research line include a strategic co-operation with the company s::can Messtechnik GmbH from Austria and its Spanish daughter company s::can Iberia S.L. In 2017, Mireia Plà Castellana commenced an Industrial Doctorate co-funded by the Government of Catalonia to work on chemometric methods for enabling contaminant detection using optical spectroscopic sensors. Other activities include collaborations on developing algorithms for mixing sources in complex water supplies with the University of Girona.

by the Spanish Government through the REACH project which ended in December 2018. The effect of seasonal temperature variations and rain events on N<sub>2</sub>O emissions from wastewater treatment systems was assessed during this last year of the project. This investigation resulted in a publication in the *Chemosphere* journal and another one currently in preparation. The visiting PhD student involved in this project, Zhiyuan Bao from Beijing Forestry University, also completed his 2-year visit and returned to China to complete his PhD.

The second block of activities conducted during 2018 focused on recovering resources from wastewater. Within this line, the research funded by the EU WaterWorks call (Water JPI) via the WATINTECH project focused on improving methane production through anaerobic digestion of concentrated wastewater via a forward osmosis process. This work is part of the ongoing PhD thesis of Federico Ferrari, and the UdG student Erik Fernandez has given support for a few months. During 2018, the effect of temperature variations on the performance of this bioreactor was assessed and the results summarised in a scientific publication which is currently under review. Currently, a forward osmosis system is being operated to obtain real concentrated wastewater which is treated by the anaerobic digester pilot plant. This project will be completed during 2019.

In the scope of the same JPI Water WATINTECH project, we are developing an electrochemical treatment unit for efficient oxidation and removal of sulphide from wastewater. Hydrogen sulphide (H<sub>2</sub>S) is formed by the biological reduction of sulphates and the decomposition of organic material. In spite of being present at relatively low concentrations in wastewater, sulphide represents a major problem for municipal wastewater systems as it is toxic, corrosive and odorous. Sulphide is often formed in high concentrations during anaerobic digestion processes, where sulphate-reducing bacteria compete with methanogens and decrease the yield and quality of the produced biogas. Research conducted at ICRA is focused on the use of flow-through reactors with porous anodes based on nanostructured coatings of Mn-oxides (e.g., nanoplates of Mn<sub>2</sub>O<sub>4</sub>). These electrode materials are capable of selective oxidation of sulphide to sulphur, which allows its separation from the wastewater/digestate without changing the wastewater composition or affecting the microbial community in anaerobic digestion. Sulphur electrodeposited at the electrode can be recovered by a simple polarity switch, which at the same time allows for regeneration

of the electrode surface before the next working cycle. This work is conducted in the scope of the PhD thesis of Natalia Sergienko.

In July 2018, the NEWBIES project awarded within the LIFE17 ENVINL call started. This project coordinated by WETSUS, a European centre of excellence for sustainable water technology, focuses on the demonstration of an innovative electrochemical system for the recovery of nitrogen from different wastewater streams. A demonstration plant has been designed and constructed and will be installed in the Girona WWTP during 2019 for the recovery of nitrogen from the reject wastewater stream produced in the plant.

The third research topic deals with organic micropollutants (pharmaceutical, endocrine disrupting compounds and Watch List compounds) in order to expand knowledge of their removal/biodegradation mechanisms using different mixed microbial cultures (nitrifiers, heterotrophic bacteria, anammox, facultative anaerobes, etc.) in the framework of the PhD theses of Elisavet Kassotaki, who vivaed in September 2018, and Lucia Gusmaroli. The tests conducted consider not only the parent compounds but also their transformation products, which is important to determine their real elimination. Moreover, tailored studies on the presence and removal of these compounds in greywater (by means of hydroponic technologies and other biologically-based technologies) and in swimming pool water (by advanced disinfection technology) have been performed and the results are under evaluation. Furthermore, as part of TreatRec and micropollutants removal the research fellow Luca Sbardella has worked out the results from a biological-activated carbon filter and in sulphate radical-based oxidation experiments.

Following the expertise achieved on water reuse (in particular the demEAUmed project with ICRA as project scientific coordinator, 2014-2017) and nutrients recovery, the fourth research topic within this line is expanding its activities towards the circular economy concept and nature-based solutions with the HYDROUSA and the CLEaN-TOUR project, in the context of Mediterranean areas and tourist installations, and the COST action Circular City Re.Solution.

The H2o2o project HYDROUSA "Demonstration of water loops with innovative regenerative business models for the Mediterranean region" has been funded. This project (2018-2022) will provide innovative, nature-based water management solutions for Mediterranean islands and coastal areas for wastewater treatment and nutrient recovery, supplying fresh water from non-conventional water sources and also for agricul-

## ▶ LINE 2 WASTEWATER TREATMENT, REUSE AND RESOURCE RECOVERY

Research conducted under this line aims to improve current technologies and develop novel tools for treating wastewater and reusing it in centralised and decentralised systems, including nature-based solutions. Achieving better treatment performance, recovering energy and nutrients and reducing detrimental emissions including organic micropollutants are the goals of this line. The experimental approach ranges from fundamental to applied research, with most of the projects involving strong involvement and participation by industry partners and water utilities.

The main activities focus on the following themes:

- Minimising the carbon footprint and detri-

mental emissions of the urban wastewater system as a whole (sewers, wastewater treatment plants and receiving water bodies),

- Resource recovery through wastewater treatment,
- Monitoring organic micropollutants in the environment and biodegradation/ removal by means of several treatment technologies,
- The circular economy and nature-based solutions for optimal and safe closed water cycle in the Mediterranean region and in tourist facilities.

The first block of activities related to reducing the carbon footprint of our wastewater transport and treatment systems was mainly funded



ture purposes. It will establish the water-energy-food-employment nexus by creating jobs, boosting the economy and making sure that the community and stakeholders are engaged.

The RETOS project CLEaN-TOUR (2018-2020) "Circular economy to facilitate urban water reuse in a touristic city: centralised or decentralised?" is being conducted in collaboration with the AIII3 line and as part of the PhD thesis of Esther Mendoza. The aim is to demonstrate the safety of regenerated water for irrigation and other uses, thus taking a step towards the circular economy in touristic regions. It will analyse centralised systems and decentralised

systems (segregating different types of water) to address: (i) the elimination of microcontaminants and some pathogens, (ii) the evaluation of possible risks of water reuse, and (iii) the difficulties in selecting the most suitable scenario (centralised or decentralised) with innovative treatment technologies such as osmotic membrane bioreactors and hydroponic technologies for greywater treatment with edible plants.

Finally, ICRA is also active in the Circular City Resolution (Implementing nature based solutions for creating a resourceful circular city) COST action (2018-2022) with Gianluigi Buttiglieri as MC for Spain and many other ICRA researchers involved.

## ▶ LINE 3 MODELLING AND MANAGEMENT SYSTEMS

The main focus is on the development of tools and methodologies to support urban water system (UWS) management. Line III.3 seeks the integration of subsystems (e.g. sewer systems, wastewater treatment plants and receiving water bodies) and the planning of smart and sustainable cities.

The main activities focus on the following three themes:

- Integrated management of urban wastewater systems
- Maintenance and upgrade of urban wastewater systems
- Planning of smart and sustainable cities

Regarding the integrated management of urban wastewater systems and rivers, two studies were completed. First, the work by Ignasi Aymerich on the case study of Puigcerdà to better understand the transformation of organic matter, nitrogen, phosphorus and organic microcontaminants in sewers, wastewater treatment plants and rivers. His PhD thesis was submitted in late 2018 and vivaed in January 2019. Second, the work by Pau Gimeno on the upgrade of urban wastewater infrastructure for pharmaceutical removal at the catchment scale. His latest study was on the evaluation of source control measures (e.g. substitution of environmentally harmful pharmaceuticals by less environmentally harmful substances) to achieve concentrations in rivers lower than environmental quality standards. His work concluded that the substi-

tution of diclofenac by naproxen would benefit the environment.

With regards to the maintenance of urban wastewater systems, the team consisting of Silvia Busquets, Adrià Riu and Lluís Bosch has made great progress on the GESTOR project. SENVES, the device for monitoring combined sewer overflows, has been upgraded with Lora technology to improve the transfer of data. The study on distributed temperature sensing for the detection of infiltration in sewers was completed.

Within this same research line, Pau Juan Garcia completed his thesis on the topic of resilience of wastewater treatment plants. He proposed a model-based quantitative resilience framework for wastewater treatment plants in cooperation with inCTRL Solutions Inc., using the software platform SIMBA# and taking the Girona WWTP as a case study.

Line III.3 is involved in the development of DSS for several purposes in wastewater management. During 2018, we continued our cooperation with the International Water Association and GIZ to deliver the second version of the ECAM tool, a platform for utilities to monitor their GHG emissions and energy use (Lluís Bosch). A DSS for the JPI Watintech project is being developed with the support of the UdG student Anastasya Kravtchenko to identify the most appropriate dynamic integration of decentralised technologies for rainwater harvesting and the recovery of water-energy ad-

ded-value products from sewer mining. Dante Maschio is studying the role of micropollutants under different global scenarios related to the sustainable development goals. Finally, Adrià Riu developed a DSS for the selection of the most adequate treatment technology for nitrate removal in groundwater in cooperation with the Catalan Water Agency (ACA) and Catalan Water Partnership. In addition, we have started a project with Global Omnium to develop a web-based recommender for the operation of wastewater treatment plants following the principles of the Water Framework Directive. Anna Valls and Lluís Bosch have been working to deliver the first version of the tool.

Built on expertise on multi-criteria DSS development, the III.3 line in collaboration with the Resources and Ecosystems area is expanding its activities towards the planning of smart and sustainable cities thanks to the H2020 EdiCitNet. The project started in 2018 and will demonstrate the cost-effectiveness and economic viability of the systemic use of natu-

re-based solutions for urban food production (edible city solutions) as a major step towards more sustainable, resilient and socially just cities. Also, within the SNAPP project Sanitation for and by Nature (SANNAT), we are developing a web-based decision support tool to help outline benefits and conditions where different nature-based solutions can be integrated into wastewater treatment processes.

Finally, AIII3 has been awarded two H2020 projects related to the development of digital solutions for the water sector. The project SCOREwater (Smart City Organised and Resilient Water Management) aims at enhancing the resilience of cities by the digitalisation of the water sector, while ICRA contributes with the development of sewage information mining techniques. ICRA contributes to the project DWC (DIGITAL-WATER CITY- Leading urban water management to its digital future) with the deployment of smart sensors for monitoring combined sewer overflows and using that information to better manage sewer system infrastructure.



### AIII- PHD DISSERTATIONS

**JULIAN MAMO.** *Assessment and optimization of the operation of integrated membrane systems for wastewater reclamation.* Supervisors: Joaquim Comas Matas, Hèctor Monclús and Ignasi Rodríguez-Roda Layret. 11<sup>th</sup> December 2018.

**ELISSAVET KASSOTAKI.** *Elimination of micropollutants in conventional and novel nitrogen removal processes - A comparative assessment of diverse microbial communities' capabilities.* Supervisors: Maite Pijuan, Gianluigi Buttiglieri and Ignasi Rodríguez-Roda Layret. Excellent Cum Laude. 7<sup>th</sup> September 2018.

### VISITING SCIENTISTS

**LUCA SBARDELLA** – Visiting Scientist of Aquafin – (January-June 2018).

### VISITING STUDENTS

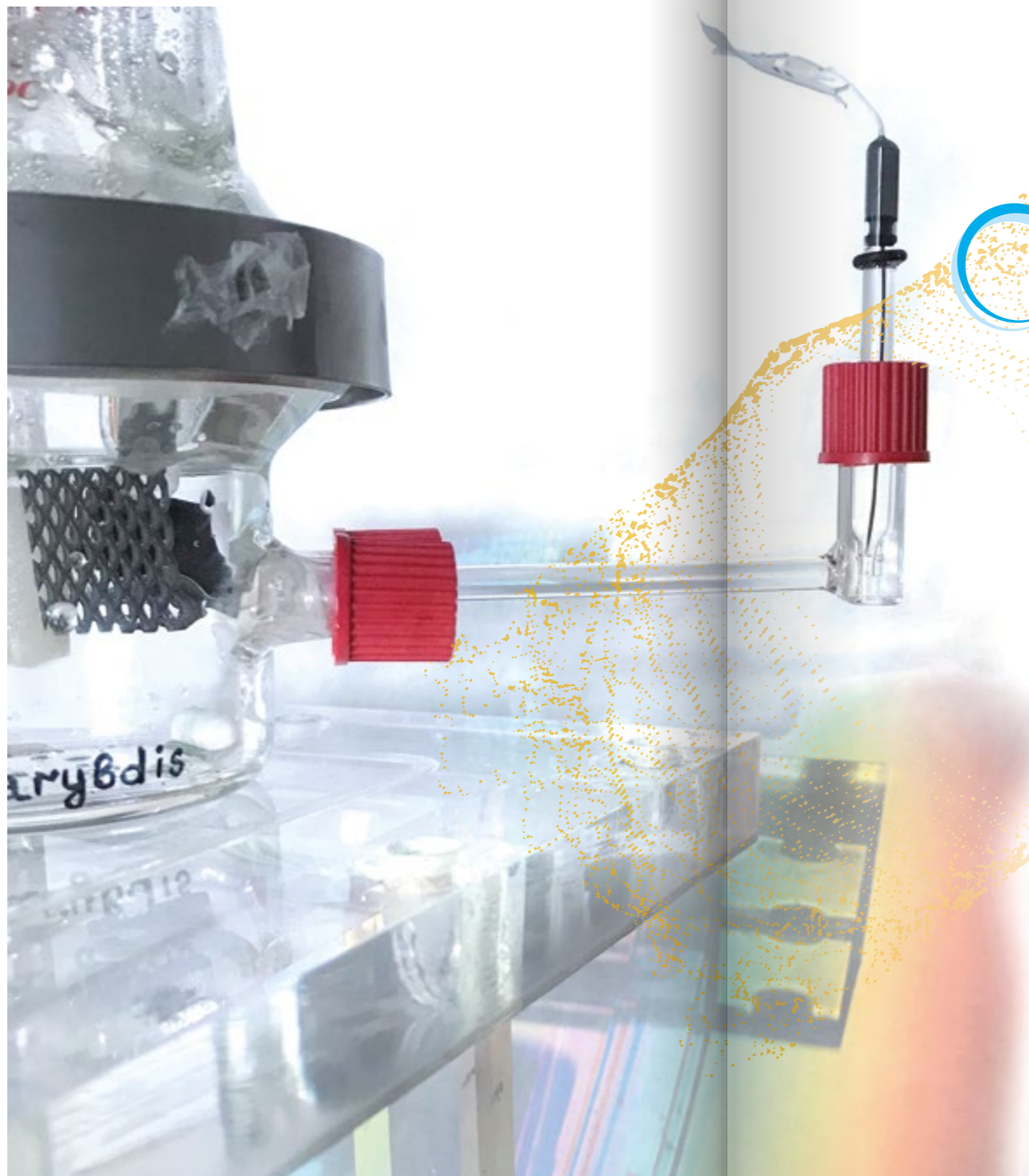
**LUCA SBARDELLA** – Visiting Student of UdG – (August-October 2018).

**ZHIYUAN BAO** – Internship Student of Beijing Forestry University – (January-October 2018).

**RUGGERO RAPISARDA** – Università Degli Studi Di Catania (July 2018).

### AIII – STAYS ABROAD

Gianluigi Buttiglieri at UNIVPM, **Department of Materials, Environmental Sciences and Urban Planning**, (Ancona, Italy) with Prof. Francesco Fatone and Dr. Anna Laura Eusebi in the period 10<sup>th</sup> September until 8<sup>th</sup> October 2018.



04

# PUBLICATIONS & CONGRESSES

TOTAL PUBLICATIONS:  
**128**



## SCI PUBLICATIONS (SCIENCE CITATION INDEX 2017)

(Publications ordered alphabetically)

Abdelhafidh, K., Ali, M., Hassen, K., Badreddine, S., Jaume, A., Sandra, P., Ethel, E., Damià, B., Hamouda, B., Ezzeddine, M. **Uptake and metabolism of carbamazepine (CBZ) by clam *Ruditapes decussatus* and its effects in biochemical responses** (2018) *Xenobiotica*, 48 (7), 727-733. IF=1,857, Q3

Aguilera, R., Sabater, S., Marcé, R. **A methodological framework for characterizing the spatiotemporal variability of river water-quality patterns using dynamic factor analysis** (2018) *Journal of Environmental Informatics*, 31 (2), 97-110. IF=4,521, Q1

Álvarez-Muñoz, D., Rodríguez-Mozaz, S., Jacobs, S., Serra-Compte, A., Cáceres, N., Sioen, I., Verbeke, W., Barbosa, V., Ferrari, F., Fernández-Tejedor, M., Cunha, S., Granby, K., Robbens, J., Kotterman, M., Marques, A., Barceló, D. **Pharmaceuticals and endocrine disruptors in raw and cooked seafood from European market: Concentrations and human exposure levels** (2018) *Environment International*, 119, 570-581. IF=7,297, Q1

Alves, T.C., Cabrera-Codony, A., Barceló, D., Rodríguez-Mozaz, S., Pinheiro, A., Gonzalez-Olmos, R. **Influencing factors on the removal of pharmaceuticals from water with micro-grain activated carbon** (2018) *Water Research*, 144, 402-412. IF=7,051, Q1

Amalfitano, S., Fazi, S., Ejarque, E., Freixa, A., Romani, A.M., Butturini, A. **Deconvolution model to resolve cytometric microbial community patterns in flowing waters** (2018) *Cytometry Part A*, 93 (2), 194-200. IF=3,260, Q2

Andrés García, E., Agulló-Barceló, M., Bond, P., Keller, J., Gernjak, W., Radjenovic, J. **Hybrid electrochemical-granular activated carbon system for the treatment of greywater** (2018) *Chemical Engineering Journal*, 352, 405-411. IF=6,735, Q1

Attermeyer, K., Catalán, N., Einarsdottir, K., Freixa, A., Groeneveld, M., Hawkes, J.A., Bergquist, J., Tranvik, L.J. **Organic Carbon Processing During Transport Through Boreal Inland Waters: Particles as Impor-**

**tant Sites** (2018) *Journal of Geophysical Research: Biogeosciences*, 123 (8), 2412-2428. IF=3,484, Q2

Aznar-Alemany, Ò., Aminot, Y., Vilà-Cano, J., Köck-Schulmeyer, M., Readman, J.W., Marques, A., Godinho, L., Botteon, E., Ferrari, F., Boti, V., Albanis, T., Eljarrat, E., Barceló, D. **Halogenated and organophosphorus flame retardants in European aquaculture samples** (2018) *Science of the Total Environment*, 612, 492-500. IF=4,610, Q1

Balcázar, J.L. **How do bacteriophages promote antibiotic resistance in the environment?** (2018) *Clinical Microbiology and Infection*, 24 (5), 447-449. IF=5,394, Q1

Bao, Z., Ribera-Guardia, A., Spinelli, M., Sun, D., Pijuan, M. **The effect of temperature shifts on N<sub>2</sub>O and NO emissions from a partial nitrification reactor treating reject wastewater** (2018) *Chemosphere*, 212, 162-169. IF=4,427, Q1

Barreto, A., Luis, L.G., Paíga, P., Santos, L.H.M.L.M., Delerue-Matos, C., Soares, A.M.V.M., Hylland, K., Loureiro, S., Oliveira, M. **A multibiomarker approach highlights effects induced by the human pharmaceutical gemfibrozil to gilthead seabream *Sparus aurata*** (2018) *Aquatic Toxicology*, 200, 266-274. IF=3,884, Q1

Batalla, R.J., Iroumé, A., Hernández, M., Llena, M., Mazzorana, B., Vericat, D. **Recent geomorphological evolution of a natural river channel in a Mediterranean Chilean basin** (2018) *Geomorphology*, 303, 322-337. IF=3,308, Q2

Béjar, M., Vericat, D., Batalla, R.J., Gibbins, C.N. **Variation in flow and suspended sediment transport in a montane river affected by hydropeaking and instream mining** (2018) *Geomorphology*, 310, 69-83. IF=3,308, Q2

Béjar, M., Vericat, D., Nogales, I., Gallart, F., Batalla, R.J. **Effects of gravel mining on suspended sediment transport in mountain rivers (Upper River Cinca, central Pyrenees) [Efectos de las extracciones de áridos sobre el transporte de sedimentos en sus-**

**pensión en ríos de montaña (Alto río cinca, pirineo central)]** (2018) *Geographical Research Letters*, 44 (2), 641-658. IF=1,343, Q3

Beneta, A., Mutavdžić Pavlović, D., Periša, I., Petrović, M. **Multiresidue GC-MS/MS pesticide analysis for evaluation of tea and herbal infusion safety** (2018) *International Journal of Environmental Analytical Chemistry*, 98 (11), 987-1004. IF=1,372, Q3

Bengtsson, M.M., Attermeyer, K., Catalán, N. **Interactive effects on organic matter processing from soils to the ocean: are priming effects relevant in aquatic ecosystems?** (2018) *Hydrobiologia*, 822 (1). IF=2,165, Q2

Bernal, S., Lupon, A., Catalán, N., Castelar, S., Martí, E. **Decoupling of dissolved organic matter patterns between stream and riparian groundwater in a headwater forested catchment** (2018) *Hydrology and Earth System Sciences*, 22 (3), 1897-1910. IF=4,256, Q1

Bikfalvi, A., Marques, P., Pérez-Cabaní, M.-L., Juandó Bosch, J., Rodríguez-Roda, I. **Bridging academia and water-related business through competence development: Evidence from a pan-European project** (2018) *Journal of Cleaner Production*, 171, S20-S33. IF=5,651, Q1

Blandin, G., Gautier, C., Sauchelli Toran, M., Monclús, H., Rodríguez-Roda, I., Comas, J. **Retrofitting membrane bioreactor (MBR) into osmotic membrane bioreactor (OMBR): A pilot scale study** (2018) *Chemical Engineering Journal*, 339, 268-277. IF=6,735, Q1

Boy-Roura, M., Mas-Pla, J., Petrovic, M., Gros, M., Soler, D., Brusi, D., Menció, A. **Towards the understanding of antibiotic occurrence and transport in groundwater: Findings from the Baix Fluvià alluvial aquifer (NE Catalonia, Spain)** (2018) *Science of the Total Environment*, 612, 1387-1406. IF=4,610, Q1

Cáceres, L., Méndez, D., Fernández, J., Marcé, R. **From End-of-Pipe to Nature Based Solutions: a Simple Statistical Tool for Maximizing the Ecosystem Services Provided by Reservoirs for Drinking Water Treatment** (2018) *Water Resources Management*, 32 (4), 1307-1323. IF=2,644, Q1

Cardoso-Silva, S., López-Doval, J.C., Moschini-Carlos, V., Pompêo, M. **Metals and limnological variables in an urban reservoir: compartmentalization and**

**identification of potential impacted areas** (2018) *Environmental Monitoring and Assessment*, 190 (1), art. no. 19. IF=1,804, Q3

Castellet-Rovira, F., Lucas, D., Villagrasa, M., Rodríguez-Mozaz, S., Barceló, D., Sarrà, M. ***Stropharia rugosoannulata* and *Gymnopilus luteofolius*: Promising fungal species for pharmaceutical biodegradation in contaminated water** (2018) *Journal of Environmental Management*, 207, 396-404. IF=4,005, Q1

Catalán, N., Casas-Ruiz, J.P., Arce, M.I., Abril, M., Bravo, A.G., del Campo, R., Estévez, E., Freixa, A., Giménez-Grau, P., González-Ferreras, A.M., Gómez-Gener, L., Lupon, A., Martínez, A., Palacin-Lizarbe, C., Poblador, S., Rasines-Ladero, R., Reyes, M., Rodríguez-Castillo, T., Rodríguez-Lozano, P., Sanpera-Calbet, I., Tornero, I., Pastor, A. **Behind the Scenes: Mechanisms Regulating Climatic Patterns of Dissolved Organic Carbon Uptake in Headwater Streams** (2018) *Global Biogeochemical Cycles*, 32 (10), 1528-1541. IF=4,457, Q1

Čizmić, M., Ljubas, D., Škorić, I., Rožman, M., Ašperger, D., Čurković, L., Petrović, M., Babić, S. **Photolytic and photocatalytic degradation of febantel in aqueous media** (2018) *Desalination and Water Treatment*, 104, 294-303. IF=1,383, Q3

Compte-Port, S., Borrego, C.M., Moussard, H., Jeanbille, M., Restrepo-Ortiz, C.X., de Diego, A., Rodríguez-Irretagoiena, A., Gredilla, A., Fdez-Ortiz de Vallejuelo, S., Galand, P.E., Kalenitchenko, D., Rols, J.-L., Pokrovsky, O.S., Gonzalez, A.G., Camarero, L., Muñiz, S., Navarro-Navarro, E., Auguet, J.-C. **Metal contaminations impact archaeal community composition, abundance and function in remote alpine lakes** (2018) *Environmental Microbiology*, 20 (7), 2422-2437. IF=4,974, Q1

Corominas, L., Garrido-Baserba, M., Villeg, K., Olsson, G., Cortés, U., Poch, M. **Transforming data into knowledge for improved wastewater treatment operation: A critical review of techniques** (2018) *Environmental Modelling and Software*, 106, 89-103. IF=4,177, Q1

Dafouz, R., Cáceres, N., Rodríguez-Gil, J.L., Mastroianni, N., López de Alda, M., Barceló, D., de Miguel, Á.G., Valcárcel, Y. **Does the presence of caffeine in the marine environment represent an environmental risk? A regional and global study** (2018) *Science of the Total Environment*, 615, 632-642. IF=4,610, Q1

Dalahmeh, S., Ahrens, L., Gros, M., Wiberg, K., Pell, M. **Potential of biochar filters for onsite sewage treatment: Adsorption and biological degradation of pharmaceuticals in laboratory filters with active, inactive and no biofilms** (2018) *Science of the Total Environment*, 612, 192-201. IF=4,610, Q1

de la Fuente, M., Bonada, N., Bêche, L., Dahm, C.N., Mendez, P.K., Tockner, K., Uehlinger, U., Acuña, V. **Evolutionary responses of aquatic macroinvertebrates to two contrasting flow regimes** (2018) *Hydrobiologia*, 808 (1), 353-370. IF=2,165, Q2

de Sousa, D.N.R., Insa, S., Mozeto, A.A., Petrovic, M., Chaves, T.F., Fadini, P.S. **Equilibrium and kinetic studies of the adsorption of antibiotics from aqueous solutions onto powdered zeolites** (2018) *Chemosphere*, 205, 137-146. IF=4,427, Q1

de Souza Beghelli, F.G., Lopez-Dovál, J.C., Rosa, A.H., Pompêo, M., Carlos, V.M. **Lethal and sublethal effects of metal-polluted sediments on *Chironomus sancticaroli* Strixino and Strixino, 1981** (2018) *Ecotoxicology*, 27 (3), 286-299. IF=1,987, Q3

E. Eljarrat and D. Barceló. **How do measured PBDE and HCB levels in river fish compare to the European Environmental Quality Standards?** (2018) *Environmental Research*, 160, 203-211. IF=4,732, Q1

Farhat, A., Keller, J., Tait, S., Radjenovic, J. **Oxidative capacitance of sulfate-based boron-doped diamond electrochemical system** (2018) *Electrochemistry Communications*, 89, 14-18. IF=4,660, Q1

Feijóo, C., Messetta, M.L., Hegoburu, C., Gómez Vázquez, A., Guerra-López, J., Mas-Pla, J., Rigacci, L., García, V., Butturini, A. **Retention and release of nutrients and dissolved organic carbon in a nutrient-rich stream: A mass balance approach** (2018) *Journal of Hydrology*, 566, 795-806. IF=3,727, Q1

Francke, T., Foerster, S., Brosinsky, A., Sommerer, E., Lopez-Tarazon, J.A., Güntner, A., Batalla, R.J., Bronstert, A. **Water and sediment fluxes in Mediterranean mountainous regions: Comprehensive dataset for hydro-sedimentological analyses and modelling in a mesoscale catchment (River Isábena, NE Spain)** (2018) *Earth System Science Data*, 10 (2), 1063-1075. IF=8,792, Q1

Frassl, M.A., Hamilton, D.P., Denfeld, B.A., de Eyto, E., Hampton, S.E., Keller, P.S., Sharma, S., Lewis, A.S.L.,

Weyhenmeyer, G.A., O'Reilly, C.M., Lofton, M.E., Catalán, N. **Ten simple rules for collaboratively writing a multi-authored paper** (2018) *PLoS Computational Biology*, 14 (11), art. no. e1006508. IF=3,955, Q1

Freixa, A., Acuña, V., Gutierrez, M., Sanchis, J., Santos, L.H.M.L.M., Rodríguez-Mozaz, S., Farré, M., Barceló, D., Sabater, S. **Fullerenes influence the toxicity of organic micro-contaminants to river biofilms** (2018) *Frontiers in Microbiology*, 9 (JUL), art. no. 1426. IF=4,019, Q2

Freixa, A., Acuña, V., Sanchis, J., Farré, M., Barceló, D., Sabater, S. **Ecotoxicological effects of carbon based nanomaterials in aquatic organisms** (2018) *Science of the Total Environment*, 619-620, 328-337. IF=4,610, Q1

Gibert, K., Izquierdo, J., Sánchez-Marrè, M., Hamilton, S.H., Rodríguez-Roda, I., Holmes, G. **Which method to use? An assessment of data mining methods in Environmental Data Science** (2018) *Environmental Modelling and Software*, 110, 3-27. IF=4,177, Q1

Gimeno, P., Severyns, J., Acuña, V., Comas, J., Corominas, L. **Balancing environmental quality standards and infrastructure upgrade costs for the reduction of microcontaminant loads in rivers** (2018) *Water Research*, 143, 632-641. IF=7,051, Q1

Ginebreda, A., Sabater-Liesa, L., Rico, A., Focks, A., Barceló, D. **Reconciling monitoring and modeling: An appraisal of river monitoring networks based on a spatial autocorrelation approach - emerging pollutants in the Danube River as a case study** (2018) *Science of the Total Environment*, 618, 323-335. IF=4,610, Q1

Giulivo, M., Suci, N.A., Eljarrat, E., Gatti, M., Capri, E., Barceló, D. **Ecological and human exposure assessment to PBDEs in Adige River** (2018) *Environmental Research*, 164, 229-240. IF=4,732, Q1

Gómez-Gener, L., Gubau, M., von Schiller, D., Marcé, R., Obrador, B. **Effect of small water retention structures on diffusive CO<sub>2</sub> and CH<sub>4</sub> emissions along a highly impounded river** (2018) *Inland Waters*, 8 (4), 449-460. IF=1,663, Q2

Gonzalez-Martinez, A., Margareto, A., Rodriguez-Sanchez, A., Pesciaroli, C., Diaz-Cruz, S., Barceló, D., Vahala, R. **Linking the effect of antibiotics on partial-nitritation biofilters: Performance, microbial communities**

**and microbial activities** (2018) *Frontiers in Microbiology*, 9 (FEB), art. no. 354. IF=4,019, Q2

Gusmaroli, L., Insa, S., Petrovic, M. **Development of an online SPE-UHPLC-MS/MS method for the multiresidue analysis of the 17 compounds from the EU "Watch list"** (2018) *Analytical and Bioanalytical Chemistry*, 410 (17), 4165-4176. IF=3,307, Q2

Hallaji, S.M., Torabian, A., Aminzadeh, B., Zahedi, S., Eshtiaghi, N. **Improvement of anaerobic digestion of sewage mixed sludge using free nitrous acid and Fenton pre-treatment** (2018) *Biotechnology for Biofuels*, 11 (1), art. no. 233. IF=5,497, Q1

Hernández-del Amo, E., Menció, A., Gich, F., Mas-Pla, J., Bañeras, L. **Isotope and microbiome data provide complementary information to identify natural nitrate attenuation processes in groundwater** (2018) *Science of the Total Environment*, 613-614, 579-591. IF=4,610, Q1

Herrero Ortega, S., Catalán, N., Björn, E., Gröntoft, H., Hilmarsson, T.G., Bertilsson, S., Wu, P., Bishop, K., Levanoni, O., Bravo, A.G. **High methylmercury formation in ponds fueled by fresh humic and algal derived organic matter** (2018) *Limnology and Oceanography*, 63, 544-553. IF=3,595, Q1

Herrero, A., Gutiérrez-Cánovas, C., Vigiak, O., Lutz, S., Kumar, R., Gampe, D., Huber-García, V., Ludwig, R., Batalla, R., Sabater, S. **Multiple stressor effects on biological quality elements in the Ebro River: Present diagnosis and predicted responses** (2018) *Science of the Total Environment*, 630, 1608-1618. IF=4,610, Q1

Herrero, A., Vila, J., Eljarrat, E., Ginebreda, A., Sabater, S., Batalla, R.J., Barceló, D. **Transport of sediment borne contaminants in a Mediterranean river during a high flow event** (2018) *Science of the Total Environment*, 633, 1392-1402. IF=4,610, Q1

Hofer, T., Montserrat, A., Gruber, G., Gämmerl, V., Corominas, L., Muschalla, D. **A robust and accurate surrogate method for monitoring the frequency and duration of combined sewer overflows** (2018) *Environmental Monitoring and Assessment*, 190 (4), art. no. 209. IF=1,804, Q3

Huerta, B., Rodríguez-Mozaz, S., Lazorchak, J., Barceló, D., Batt, A., Wathen, J., Stahl, L. **Presence of pharmaceuticals in fish collected from urban rivers**

**in the U.S. EPA 2008-2009 National Rivers and Streams Assessment** (2018) *Science of the Total Environment*, 634, 542-549. IF=4,610, Q1

J. Mamo, M.J.; García-Galán, M. Stefani, S. Rodríguez-Mozaz, D. Barceló, H. Monclús, I. Rodríguez-Roda and J. Comas. **Fate of pharmaceuticals and their transformation products in integrated membrane systems for wastewater reclamation** (2018) *Chemical Engineering Journal*, 331, 450-461. IF=6,735, Q1

Jaén-Gil, A., Hom-Díaz, A., Llorca, M., Vicent, T., Blázquez, P., Barceló, D., Rodríguez-Mozaz, S. **An automated on-line turbulent flow liquid-chromatography technology coupled to a high resolution mass spectrometer LTQ-Orbitrap for suspect screening of antibiotic transformation products during microalgae wastewater treatment** (2018) *Journal of Chromatography A*, 1568, 57-68. IF=3,716, Q1

Juan-García, P., Kiser, M.A., Schraa, O., Rieger, L., Corominas, L. **Dynamic air supply models add realism to the evaluation of control strategies in water resource recovery facilities** (2018) *Water Science and Technology*, 78 (5), 1104-1114. IF=1,247, Q3

Juez, C., Tena, A., Fernández-Pato, J., Batalla, R.J., García-Navarro, P. **Application of a distributed 2d overland flow model for rainfall/runoff and erosion simulation in a mediterranean watershed [Aplicación de un modelo distribuido 2d para simular la transformación de lluvia en escorrentía y la erosión del suelo en una cuenca mediterránea]** (2018) *Geographical Research Letters*, 44 (2), 615-640. IF=1,343, Q3

Karaouzas, I., Smeti, E., Yourka, A., Vardakas, L., Mentzafou, A., Tornés, E., Sabater, S., Muñoz, I., Skoulikidis, N.T., Kalogianni, E. **Assessing the ecological effects of water stress and pollution in a temporary river - Implications for water management** (2018) *Science of the Total Environment*, 618, 1591-1604. IF=4,610, Q1

Kassotaki, E., Pijuan, M., Joss, A., Borrego, C.M., Rodríguez-Roda, I., Buttiglieri, G. **Unraveling the potential of a combined nitritation-anammox biomass towards the biodegradation of pharmaceutically active compounds** (2018) *Science of the Total Environment*, 624, 722-731. IF=4,610, Q1

Kosjek, T., Negreira, N., Heath, E., López de Alda, M., Barceló, D. **Aerobic activated sludge transformation of vincristine and identification of the transformation products** (2018) *Science of the Total Environment*, 610-611, 892-904. IF=4,610, Q1



Leal, P.R., Moschini-Carlos, V., López-Doval, J.C., Cintra, J.P., Yamamoto, J.K., Bitencourt, M.D., Santos, R.F., Abreu, G.C., Pompêo, M.L.M. **Impact of copper sulfate application at an urban Brazilian reservoir: A geostatistical and ecotoxicological approach** (2018) *Science of the Total Environment*, 618, 621-634. IF=4,610, Q1

Lekunberri, I., Balcázar, J.L., Borrego, C.M. **Metagenomic exploration reveals a marked change in the river resistome and mobilome after treated wastewater discharges** (2018) *Environmental Pollution*, 234, 538-542. IF=4,358, Q1

Limberger, R., Birtel, J., Peter, H., Catalán, N., da Silva Farias, D., Best, R.J., Brodersen, J., Bürgmann, H., Matthews, B. **Predator-induced changes in dissolved organic carbon dynamics** (2018) *Oikos*. Article in Press. IF=3,709, Q1

Llorca, M., Farré, M., Sánchez-Melsió, A., Villagrasa, M., Knepper, T.P., Barceló, D. **Perfluoroalkyl phosphonic acids adsorption behaviour and removal by wastewater organisms** (2018) *Science of the Total Environment*, 636, 273-281. IF=4,610, Q1

Llorca, M., Schirinzí, G., Martínez, M., Barceló, D., Farré, M. **Adsorption of perfluoroalkyl substances on microplastics under environmental conditions** (2018) *Environmental Pollution*, 235, 680-691. IF=4,358, Q1

López-García, E., Mastroianni, N., Postigo, C., Barceló, D., López de Alda, M. **A fully automated approach for the analysis of 37 psychoactive substances in raw wastewater based on on-line solid phase extraction-liquid chromatography-tandem mass spectrometry** (2018) *Journal of Chromatography A*, 1576, 80-89. IF=3,716, Q1

López-García, E., Mastroianni, N., Postigo, C., Valcárcel, Y., González-Alonso, S., Barceló, D., López de Alda, M. **Simultaneous LC-MS/MS determination of 40 legal and illegal psychoactive drugs in breast and bovine milk** (2018) *Food Chemistry*, 245, 159-167. IF=4,946, Q1

Lucas, D., Castellet-Rovira, F., Villagrasa, M., Badia-Fabregat, M., Barceló, D., Vicent, T., Caminal, G., Sarrà, M., Rodríguez-Mozaz, S. **The role of sorption processes in the removal of pharmaceuticals by fungal treatment of wastewater** (2018) *Science of the Total Environment*, 610-611, 1147-1153. IF=4,610, Q1

Mandarić, L., Mor, J.-R., Sabater, S., Petrovic, M. **Impact of urban chemical pollution on water quality in small, rural and effluent-dominated Mediterranean streams and rivers** (2018) *Science of the Total Environment*, 613-614, 763-772. IF=4,610, Q1

Mantouzi, E., Marcé, R., Catalán, N., et al. **A European Multi Lake Survey dataset of environmental variables, phytoplankton pigments and cyanotoxins** (2018) *Scientific Data*, 5, art. no. 180226. IF=5,311, Q1

Mantouzi, E., Marcé, R., Catalán, N., et al. **Temperature effects explain continental scale distribution of cyanobacterial toxins** (2018) *Toxins*, 10 (4), art. no. 156. IF=3,273, Q2

Marcé, R., von Schiller, D., Aguilera, R., Martí, E., Bernal, S. **Contribution of Hydrologic Opportunity and Biogeochemical Reactivity to the Variability of Nutrient Retention in River Networks** (2018) *Global Biogeochemical Cycles*, 32 (3), 376-388. IF=4,457, Q1

Marques, R., Ribera-Guardia, A., Santos, J., Carvalho, G., Reis, M.A.M., Pijuan, M., Oehmen, A. **Denitrifying capabilities of Tetrasphaera and their contribution towards nitrous oxide production in enhanced biological phosphorus removal processes** (2018) *Water Research*, 137, 262-272. IF=7,051, Q1

Marshall, J.C., Acuña, V., Allen, D.C., Bonada, N., Boulton, A.J., Carlson, S.M., Dahm, C.N., Datry, T., Leigh, C., Negus, P., Richardson, J.S., Sabater, S., Jan Stevenson, R., Steward, A.L., Stubbington, R., Tockner, K., Vorste, R. **Protecting U.S. Temporary waterways** (2018) *Science*, 361 (6405), 856-857. IF=41,058, Q1

Marteau, B., Batalla, R.J., Vericat, D., Gibbins, C. **Asynchronicity of fine sediment supply and its effects on transport and storage in a regulated river** (2018) *Journal of Soils and Sediments*, 18 (7), 2614-2633. IF=2,627, Q2

Martí, E., Huerta, B., Rodríguez-Mozaz, S., Barceló, D., Marcé, R., Balcázar, J.L. **Abundance of antibiotic resistance genes and bacterial community composition in wild freshwater fish species** (2018) *Chemosphere*, 196, 115-119. IF=4,427, Q1

Mas-Pla, J., Boy-Roura, M., Petrovic, M., Villagrasa, M., Lekunberri, I., Borrego, C., Menció, A., Brusí, D., Marcé, R. **Occurrence and fate of emerging contaminants (antibiotics) in an alluvial aquifer and their effect on multi-resistant bacteria (Baix Fluvià, Ca-**

**talonia) [Occurrence et devenir des polluants émergents (antibiotiques) dans un aquifère alluvial et leur influence sur les bactéries multi-résistantes (Bas-Fluvià, Catalogne)]** (2018) *Houille Blanche*, 2018-February (1), 47-52. IF=0,129, Q4

Matheson, A., Petrovic, M. **Rapid trace analysis of multiresidue contaminants** (2018) *LC-GC Europe*, 31 (2), 102-103. IF=0,612, Q4

Maulvault, A.L., Santos, L.H.M.L.M., Camacho, C., Anacleto, P., Barbosa, V., Alves, R., Pousão Ferreira, P., Serra-Compte, A., Barceló, D., Rodríguez-Mozaz, S., Rosa, R., Diniz, M., Marques, A. **Antidepressants in a changing ocean: Venlafaxine uptake and elimination in juvenile fish (*Argyrosomus regius*) exposed to warming and acidification conditions** (2018) *Chemosphere*, 209, 286-297. IF=4,427, Q1

Maulvault, A.L., Santos, L.H.M.L.M., Paula, J.R., Camacho, C., Pissarra, V., Fogaça, F., Barbosa, V., Alves, R., Ferreira, P.P., Barceló, D., Rodríguez-Mozaz, S., Marques, A., Diniz, M., Rosa, R. **Differential behavioural responses to venlafaxine exposure route, warming and acidification in juvenile fish (*Argyrosomus regius*)** (2018) *Science of the Total Environment*, 634, 1136-1147. IF=4,610, Q1

Messetta, M.L., Hegoburu, C., Casas-Ruiz, J.P., Butturini, A., Feijóo, C. **Characterization and qualitative changes in DOM chemical characteristics related to hydrologic conditions in a Pampean stream** (2018) *Hydrobiologia*, 808 (1), 201-217. IF=2,165, Q2

Molins-Delgado, D., García-Sillero, D., Díaz-Cruz, M.S., Barceló, D. **On-line solid phase extraction-liquid chromatography-tandem mass spectrometry for insect repellent residue analysis in surface waters using atmospheric pressure photoionization** (2018) *Journal of Chromatography A*, 1544, 33-40. IF=3,716, Q1

Molins-Delgado, D., Olmo-Campos, M.D.M., Valeta-Juan, G., Pleguezuelos-Hernández, V., Barceló, D., Díaz-Cruz, M.S. **Determination of UV filters in human breast milk using turbulent flow chromatography and babies' daily intake estimation** (2018) *Environmental Research*, 161, 532-539. IF=4,732, Q1

Mor, J.-R., Ruhí, A., Tornés, E., Valcárcel, H., Muñoz, I., Sabater, S. **Dam regulation and riverine food-web structure in a Mediterranean river** (2018) *Science of the Total Environment*, 625, 301-310. IF=4,610, Q1

Muñoz, I., Abril, M., Casas-Ruiz, J.P., Casellas, M., Gómez-Gener, L., Marcé, R., Menéndez, M., Obrador, B., Sabater, S., von Schiller, D., Acuña, V. **Does the severity of non-flow periods influence ecosystem structure and function of temporary streams? A mesocosm study** (2018) *Freshwater Biology*, 63 (7), 613-625. IF=3,767, Q1

O'Flaherty, E., Balcázar, J.L., Borrego, C.M., Cummins, E. **A quantitative human exposure assessment model for antibiotic resistant *Escherichia coli* through tap water consumption** (2018) *10th International Conference on Simulation and Modelling in the Food and Bio-Industry 2018, FOODSIM 2018*, 71-73.

O'Flaherty, E., Borrego, C.M., Balcázar, J.L., Cummins, E. **Human exposure assessment to antibiotic-resistant *Escherichia coli* through drinking water** (2018) *Science of the Total Environment*, 616-617, 1356-1364. IF=4,610, Q1

Obrador, B., Von Schiller, D., Marcé, R., Gómez-Gener, L., Koschorreck, M., Borrego, C., Catalán, N. **Dry habitats sustain high CO<sub>2</sub> emissions from temporary ponds across seasons** (2018) *Scientific Reports*, 8 (1), art. no. 3015. IF=4,122, Q1

Olalla, A., Negreira, N., López de Alda, M., Barceló, D., Valcárcel, Y. **A case study to identify priority cytotoxic contaminants in hospital effluents** (2018) *Chemosphere*, 190, 417-430. IF=4,427, Q1

Onyshchenko, E., Blandin, G., Comas, J., Dvoretzky, A. **Influence of microalgae wastewater treatment culturing conditions on forward osmosis concentration process** (2018) *Environmental Science and Pollution Research*, Article in Press. IF=2,800, Q2

Palma, P., Matos, C., Alvarenga, P., Köck-Schulmeier, M., Simões, I., Barceló, D., López de Alda, M.J. **Ecological and ecotoxicological responses in the assessment of the ecological status of freshwater systems: A case-study of the temporary stream Brejo of Cagarrão (South of Portugal)** (2018) *Science of the Total Environment*, 634, 394-406. IF=4,610, Q1

Pastor, A., Catalán, N., Nagar, N., Light, T., Borrego, C.M., Marcé, R. **A universal bacterial inoculum for dissolved organic carbon biodegradation experiments in freshwaters** (2018) *Limnology and Oceanography: Methods*, 16 (7), 421-433. IF=3,595, Q1

Pelissari, C., Guivernau, M., Viñas, M., García, J., Velasco-Galilea, M., Souza, S.S., Sezerino, P.H., Ávila, C. **Effects of partially saturated conditions on the metabolically active microbiome and on nitrogen removal in vertical subsurface flow constructed wetlands** (2018) *Water Research*, 141, 185-195. IF=7,051, Q1

Pérez-Sánchez, T., Mora-Sánchez, B., Balcázar, J.L. **Biological Approaches for Disease Control in Aquaculture: Advantages, Limitations and Challenges** (2018) *Trends in Microbiology*, 26 (11), 896-903. IF=11,776, Q1

Perret, E., Berni, C., Camenen, B., Herrero, A., El Kadi Abderrezak, K. **Transport of moderately sorted gravel at low bed shear stresses: The role of fine sediment infiltration** (2018) *Earth Surface Processes and Landforms*, 43 (7), 1416-1430. IF=3,722, Q1

Picó, Y., El-Sheikh, M.A., Alfarhan, A.H., Barceló, D. **Target vs non-target analysis to determine pesticide residues in fruits from Saudi Arabia and influence in potential risk associated with exposure** (2018) *Food and Chemical Toxicology*, 111, 53-63. IF=3,977, Q1

Postigo, C., Emiliano, P., Barceló, D., Valero, F. **Chemical characterization and relative toxicity assessment of disinfection byproduct mixtures in a large drinking water supply network** (2018) *Journal of Hazardous Materials*, 359, 166-173. IF=6,434, Q1

Proia, L., Anzil, A., Subirats, J., Borrego, C.M., Farré, M., Llorca, M., Balcázar, J.L., Servais, P. **Antibiotic resistance in urban and hospital wastewaters and their impact on a receiving freshwater ecosystem** (2018) *Chemosphere*, 206, 70-82. IF=4,427, Q1

Proia, L., Anzil, A., Borrego, C., Farré, M., Llorca, M., Sanchis, J., Bogaerts, P., Balcázar, J.L., Servais, P. **Occurrence and persistence of carbapenemases genes in hospital and wastewater treatment plants and propagation in the receiving river** (2018) *Journal of Hazardous Materials*, 358, 33-43. IF=6,434, Q1

Proia, L., Anzil, A., Subirats, J., Borrego, C., Farré, M., Llorca, M., Balcázar, J.L., Servais, P. **Antibiotic resistance along an urban river impacted by treated wastewaters** (2018) *Science of the Total Environment*, 628-629, 453-466. IF=4,610, Q1

Quiroz-Guzmán, E., Peña-Rodríguez, A., Vázquez-Juárez, R., Barajas-Sandoval, D.R., Balcázar, J.L., Martínez-Díaz, S.F. **Bacteriophage cocktails as**

**an environmentally-friendly approach to prevent *Vibrio parahaemolyticus* and *Vibrio harveyi* infections in brine shrimp (*Artemia franciscana*) production** (2018) *Aquaculture*, 492, 273-279. IF=2,710, Q1

Quiroz-Guzmán, E., Vázquez-Juárez, R., Luna-González, A., Balcázar, J.L., Barajas-Sandoval, D.R., Martínez-Díaz, S.F. **Administration of Probiotics Improves the Brine Shrimp Production and Prevents Detrimental Effects of Pathogenic *Vibrio* Species** (2018) *Marine Biotechnology*, 20 (4), 512-519. IF=2,328, Q2

Rivera-Jaimes, J.A., Postigo, C., Melgoza-Alemán, R.M., Aceña, J., Barceló, D., López de Alda, M. **Study of pharmaceuticals in surface and wastewater from Cuernavaca, Morelos, Mexico: Occurrence and environmental risk assessment** (2018) *Science of the Total Environment*, 613-614, 1263-1274. IF=4,610, Q1

Romero, F., Sabater, S., Timoner, X., Acuña, V. **Multitressor effects on river biofilms under global change conditions** (2018) *Science of the Total Environment*, 627, 1-10. IF=4,610, Q1

Rožman, M., Acuña, V., Petrović, M. **Effects of chronic pollution and water flow intermittency on stream biofilms biodegradation capacity** (2018) *Environmental Pollution*, 233, 1131-1137. IF=4,358, Q1

Rubol, S., Freixa, A., Sanchez-Vila, X., Romani, A.M. **Linking biofilm spatial structure to real-time microscopic oxygen decay imaging** (2018) *Biofouling*, 34 (2), 200-211. IF=2,786, Q2

Sabater, S., Bregoli, F., Acuña, V., Barceló, D., Elosegi, A., Ginebreda, A., Marcé, R., Muñoz, I., Sabater-Liesa, L., Ferreira, V. **Effects of human-driven water stress on river ecosystems: a meta-analysis** (2018) *Scientific Reports*, 8 (1), art. no. 11462. IF=4,122, Q1

Sabater-Liesa, L., Ginebreda, A., Barceló, D. **Shifts of environmental and phytoplankton variables in a regulated river: A spatial-driven analysis** (2018) *Science of the Total Environment*, 642, 968-978. IF=4,610, Q1

Sanchis, J., Bosch-Orea, C., Farré, M., Barceló, D. **Nanoparticle tracking analysis characterisation and parts-per-quadrillion determination of fullerenes in river samples from Barcelona catchment area** (2018) *Analytical and Bioanalytical Chemistry*, 407 (15), 15 p. IF=3,307, Q2

Sanchis, J., Llorca, M., Olmos, M., Schirinzí, G.F., Bosch-Orea, C., Abad, E., Barceló, D., Farré, M. **Metabolic Responses of *Mytilus galloprovincialis* to Fullerenes in Mesocosm Exposure Experiments** (2018) *Environmental Science and Technology*, 52 (3), 1002-1013. IF=6,653, Q1

Sanchis, J., Milačić, R., Zuliani, T., Vidmar, J., Abad, E., Farré, M., Barceló, D. **Occurrence of C60 and related fullerenes in the Sava River under different hydrologic conditions** (2018) *Science of the Total Environment*, 643, 1108-1116. IF=4,610, Q1

Sauchelli, M., Pellegrino, G., D'Haese, A., Rodríguez-Roda, I., Gernjak, W. **Transport of trace organic compounds through novel forward osmosis membranes: Role of membrane properties and the draw solution** (2018) *Water Research*, 141, 65-73. IF=7,051, Q1

Sbardella, L., Comas, J., Fenu, A., Rodríguez-Roda, I., Weemaes, M. **Advanced biological activated carbon filter for removing pharmaceutically active compounds from treated wastewater** (2018) *Science of the Total Environment*, 636, 519-529. IF=4,610, Q1

Serra-Compte, A., Corcoll, N., Huerta, B., Rodríguez-Mozaz, S., Sabater, S., Barceló, D., Álvarez-Muñoz, D. **Fluvial biofilms exposed to desiccation and pharmaceutical pollution: New insights using metabolomics** (2018) *Science of the Total Environment*, 618, 1382-1388. IF=4,610, Q1

Serra-Compte, A., Maulvault, A.L., Camacho, C., Álvarez-Muñoz, D., Barceló, D., Rodríguez-Mozaz, S., Marques, A. **Effects of water warming and acidification on bioconcentration, metabolization and depuration of pharmaceuticals and endocrine disrupting compounds in marine mussels (*Mytilus galloprovincialis*)** (2018) *Environmental Pollution*, 236, 824-834. IF=4,358, Q1

Subirats, J., Timoner, X., Sánchez-Melsió, A., Balcázar, J.L., Acuña, V., Sabater, S., Borrego, C.M. **Emerging contaminants and nutrients synergistically affect the spread of class 1 integron-integrase (*intI1*) and *sul1* genes within stable streambed bacterial communities** (2018) *Water Research*, 138, 77-85. IF=7,051, Q1

Tornés, E., Mor, J.-R., Mandarić, L., Sabater, S. **Diatom responses to sewage inputs and hydrological alteration in Mediterranean streams** (2018) *Environmental Pollution*, 238, 369-378. IF=4,358, Q1

Ulloa, H., Mazzorana, B., Batalla, R.J., Jullian, C., Iribarren-Anacona, P., Barrientos, G., Reid, B., Oyarzun, C., Schaefer, M., Iroumé, A. **Morphological characterization of a highly-dynamic fluvial landscape: The River Baker (Chilean Patagonia)** (2018) *Journal of South American Earth Sciences*, 86, 1-14. IF=1,639, Q3

Valcárcel, Y., Valdehita, A., Becerra, E., López de Alda, M., Gil, A., Gorga, M., Petrovic, M., Barceló, D., Navas, J.M. **Determining the presence of chemicals with suspected endocrine activity in drinking water from the Madrid region (Spain) and assessment of their estrogenic, androgenic and thyroidal activities** (2018) *Chemosphere*, 201, 388-398. IF=4,427, Q1

Vera, R., Insa, S., Fontàs, C., Anticó, E. **A new extraction phase based on a polymer inclusion membrane for the detection of chlorpyrifos, diazinon and cyprodinil in natural water samples** (2018) *Talanta*, 185, 291-298. IF=4,244, Q1

Verdaguer, M., Molinos-Senante, M., Clara, N., Santana, M., Gernjak, W., Poch, M. **Optimal fresh water blending: A methodological approach to improve the resilience of water supply systems** (2018) *Science of the Total Environment*, 624, 1308-1315. IF=4,610, Q1

Verkh, Y., Rozman, M., Petrovic, M. **A non-targeted high-resolution mass spectrometry data analysis of dissolved organic matter in wastewater treatment** (2018) *Chemosphere*, 200, 397-404. IF=4,427, Q1

Vieira, A., Ribera-Guardia, A., Marques, R., Barreto Crespo, M.T., Oehmen, A., Carvalho, G. **The link between the microbial ecology, gene expression, and biokinetics of denitrifying polyphosphate-accumulating systems under different electron acceptor combinations** (2018) *Applied Microbiology and Biotechnology*, 102 (15), 6725-6737. IF=3,340, Q2

Vigiak, O., Lutz, S., Mentzafou, A., Chiogna, G., Tuo, Y., Majone, B., Beck, H., de Roo, A., Malagó, A., Bouraoui, F., Kumar, R., Samaniego, L., Merz, R., Gamvroudis, C., Skoulikidis, N., Nikolaidis, N.P., Bellin, A., Acuña, V., Mori, N., Ludwig, R., Pistocchi, A. **Uncertainty of modelled flow regime for flow-ecological assessment in Southern Europe** (2018) *Science of the Total Environment*, 615, 1028-1047. IF=4,610, Q1

Wang, Q., Song, K., Hao, X., Wei, J., Pijuan, M., van Loosdrecht, M.C.M., Zhao, H. **Evaluating death and activity decay of Anammox bacteria during anaero-**



bic and aerobic starvation (2018) *Chemosphere*, 201, 25-31. IF=4,427, Q1

Watson, K., Farré, M.J., Leusch, F.D.L., Knight, N. Using fluorescence-parallel factor analysis for assessing disinfection by-product formation and natural organic matter removal efficiency in secondary treat-

ted synthetic drinking waters (2018) *Science of the Total Environment*, 640-641, 31-40. IF=4,610, Q1

Zahedi, S., Romero-Güiza, M., Icaran, P., Yuan, Z., Pijuan, M. Optimization of free nitrous acid pre-treatment on waste activated sludge (2018) *Bioresource Technology*, 252, 216-220. IF=5,807, Q1

## BOOKS CHAPTERS

Bregoli, F., Medina, V., Bateman, A. (2018).TXT-tool 3.034-2.1 a debris flow regional fast hazard assessment toolbox. *Landslide Dynamics: ISDR-ICL Landslide Interactive Teaching Tools*, 2, 225-234.

López-García, C. Postigo, B. Zonja, D. Barceló and M. López de Alda (2018). "Analysis of Psychoactive Pharmaceuticals in Wastewater and Surface Water

Using LC-MS". *Elsevier*. Editors: A. Cappiello, P. Palma in *Comprehensive Analytical Chemistry*, Vol. 79, 1-24.

López-García, C. Postigo, B. Zonja, D. Barceló and M. López de Alda (2018). "Analysis of Psychoactive Pharmaceuticals in Wastewater and Surface Water Using LC-MS". *Elsevier*. Editors: A. Cappiello, P. Palma in *Comprehensive Analytical Chemistry*, Vol. 79, 29-52.

## OTHER BOOKS AND JOURNALS

Blandin, G., Rodriguez-Roda, I., Comas, J. Submerged osmotic processes: Design and operation to mitigate mass transfer limitations (2018) *Membranes*, 8 (3), art. no. 72, .

Blandin G., Le-Clech P., Cornelissen E., Verliefde A.R.D., Comas J., Rodriguez-Roda I. Can osmotic membrane bioreactor (OMBR) be a realistic solution for water reuse? (2018) *NPJ Clean Water*, 1 (7),

Harrabi, M., Varela Della Giustina, S., Aloulou, F., Rodriguez-Mozaz, S., Barceló, D., Elleuch, B. Analysis of multiclass antibiotic residues in urban wastewater

in Tunisia (2018) *Environmental Nanotechnology, Monitoring and Management*, 10, 163-170.

Mishra, V.K., Otter, P., Shukla, R., Goldmaier, A., Alvarez, J.A., Khalil, N., Avila, C., Arias, C., Ameršek, I. Application of horizontal flow constructed wetland and solar driven disinfection technologies for wastewater treatment in India (2018) *Water Practice and Technology*, 13 (3), 469-480.

Verkh, Y., Rozman, M., Petrovic, M. Extraction and cleansing of data for a non-targeted analysis of high-resolution mass spectrometry data of wastewater (2018) *MethodsX*, 5, 395-402.

## EDITORIAL BOARDS OF BOOKS AND SCIENTIFIC JOURNALS

Acuña, Vicenç, Associate Editor of *Aquatic Sciences*

Balcázar J.L. Associate Editor. *BMC Microbiology* (BioMed Central, United Kingdom) 2013 to present.

Balcázar J.L. Member of the Editorial Board. *Environmental Science and Pollution Research* (Springer, Germany). 2016 to present.

Balcázar J.L. Member of the Editorial Board. *Journal of Applied Microbiology* (Wiley, United States) 2016 to present.

Balcázar J.L. Member of the Editorial Board. *Letters in Applied Microbiology* (Wiley, United States) 2016 to present.

Balcázar J.L. Member of the Editorial Board. *Scientific Reports* (Nature Publishing Group, United Kingdom) 2012 to present.

Balcázar J.L. Review Editor. *Frontiers in Microbiology* (Frontiers, Switzerland). 2016 to present.

Barceló, D. Associate Editor. *Environment International* (Elsevier, The Netherlands) 2009 to present.

Barceló, D. Associate Editor. *Trends in Analytical Chemistry* (Elsevier, The Netherlands) 1993 to present.

Barceló, D. Co-Editor. *Handbook of Environmental Chemistry*, book series (Springer-Verlag, Germany) 2007 to present.

Barceló, D. Co-Editor-in-chief. *Science of the total Environment* (Elsevier, The Netherlands) 2012 to present.

Barceló, D. Editor. *Wilson & Wilson Comprehensive Analytical Chemistry*, book series (Elsevier, The Netherlands) 1997 to present.

Barceló, D. Member of the Editorial Board. *Analytical and Bioanalytical Chemistry* (Springer Verlag, Germany) 2002 to present.

Buttiglieri, G. is member of the scientific committee of the journal "Ingegneria dell'Ambiente (IDA)".

Comas, J. is member of the *Editorial Board of the open access journal Global Challenges and Water*.

Corominas, Ll. is member of the editorial board of the journal *water practice and technology from the International Water Association Publishing*.

Pijuan, M. is member of the editorial board of the journal *Nature Scientific Reports*.

Petrovic, M. Editor-in-chief. *TrEAC – Trends in Environmental Analytical Chemistry* (Elsevier, The Netherlands) 2014 to present.

Petrovic, M. Member of the Editorial Board. *Environmental Nanotechnology, Monitoring & Management* (Elsevier, The Netherlands) 2014 to present.

Marcé, R., Associate Editor of *Limnetica*

Rodriguez-Mozaz, S. Guest Editor. *Food and Chemical Toxicology* (Elsevier, The Netherlands) Special issue "European seafood safety" 2016

Sabater, Sergi, Editorial Associate Editor of *The Science of the Total Environment*; Editorial Board Member of *Acta Biológica Colombiana*; Associate Editor of *Freshwater Science* (specialty section of *Frontiers in Environmental Science*).

## PRESENTATION AT CONGRESSES

### ORAL PRESENTATIONS

Farré, M.J., Mamo, J., Insa, S., Jaén-Gil, A., Catalán, N., Rodríguez-Roda, I., Petrovic, M. **Adapting analytical strategies based on mass spectrometry to understand and predict and reduce NDMA formation.** *TreatRec Conference*. June 2018, Girona, Spain.

Buttiglieri G.. **"Fate of organic micropollutants in water and wastewater: monitoring and removal by means of treatment technologies"**. *Seminar for master students in Civil and Environmental Engineering – Water Utilities and Water Professionals*. 5<sup>th</sup> October 2018, Università Politecnica delle Marche (Ancona, Italy).

Buttiglieri G.. **"Innovative technologies for decentralized water reuse in the touristic sector: demEAU-med project"**. *Invited presentation for SENTINEL project*. 16<sup>th</sup> November 2018, Lloret de Mar (Spain).

Gernjak, W. **Integration of membrane and oxidation processes.** At: *Wetsus Partners conference*. Leeuwarden, Netherlands, April 2018. Invited oral presentation.

Gernjak, W. **Oxidation processes for environmental applications.** At: *Water Resources Dialogue: China-Africa Water Forum Series No.6: Sustainable Utilization of Water Resources in Developing Countries*. Sharm-el-Sheik, Egypt, July 2018. Invited plenary presentation.

Comas J.. **Osmotic membrane bioreactors for water reuse and other applications. The use of reclaimed water: best practices and new challenges.** *ALICE project thematic workshop ALICE Project mid-term meeting*. Murcia, 18th June. Invited oral presentation.

Radjenovic J. (2018) **Challenges and opportunities for electrochemical processes as next-generation technologies for the treatment of contaminated water.** *Keynote. Final TreatRec conference*, Girona, Spain.

Mas-Pla, J. (2018). **Valoración del documento "Plan especial de actuación en situación de alerta y eventual sequía, Distrito de Cuenca Fluvial de Cataluña,**

**2016: Consideraciones al plan" Jornada sobre "La revisión del Plan Especial de Sequías (PES). Las aguas subterráneas antes, durante y después de los periodos de sequía"**. Organised by *Asociaciones de Hidrogeólogos españolas (CAS, AIH, AEH) i IGME*. Madrid, 19-20 March 2018.

Mas-Pla, J. (2018). **Compuestos emergentes en las aguas subterráneas y su incidencia en la salud. Congreso Ibérico sobre Agua Subterránea, Medio Ambiente, Salud y Patrimonio.** Organised by *AIH-GE*. Salamanca, 12-15<sup>th</sup> November 2018.

Rizzo L. and Gernjak W. Round table: **State of the art of existing technologies with respect to sustainable and safe wastewater reuse.** At: *XENOWAC II. Challenges and Solutions related to Xenobiotics and Antimicrobial Resistance in the Framework of Urban Wastewater Reuse: Towards a Blue Circle Society*. Limassol, Cyprus, October 2018. Invited Chairs of Round Table Discussion.

Rodríguez-Mozaz, Sara. **Determination of Pharmaceutical Compounds and Their Transformation Products in the Aquatic Environment with LC-MS.** November 2018. Invited webinar <http://www.chromatographyonline.com/editors-series-determination-pharmaceutical-compounds-and-their-transformation-products-aquatic-envi>.

Rodríguez-Mozaz S., B. Huerta, M. Gros, G. Buttiglieri, L. Ferrando-Climent, D. Lucas, S. Chamorro, C. Cruz-Morato, T. Vicent, D. Alvarez, A. Marqués, D. Barceló. **"Medicaments: residus que també contaminen l'aigua" II Jornada de Verano de la Profesión Farmacéutica.** July 2018. Invited oral presentation in Puigcerdá, (Spain).

Rodríguez-Mozaz S., B. Huerta, M.E. Valdés, M.A. Bistoni, R. Moreno, V.León, D. Wunderlin, D. Alvarez-Muñoz, A. Marqués, D. Barceló. **Bioaccumulation of emerging organic contaminants in aquatic organisms. Chemical Analysis. Workshop on advanced techniques for the analysis of trace emerging contaminants in environmental samples.** February 2018. Invited oral presentation in Zagreb, Croatia.

Santoro D. and Gernjak, W. **Developing the next generation of UV-based advanced oxidation technologies using a dual wavelength approach: UV254nm/ H<sub>2</sub>O<sub>2</sub> and UV185nm/ H<sub>2</sub>O.** At: *XENOWAC II. Challenges and Solutions related to Xenobiotics and Antimicrobial Resistance in the Framework of Urban Wastewater Reuse: Towards a Blue Circle Society*. Limassol, Cyprus, October 2018. Invited industry-academia collaboration talk.

Sabater, S. **Premi Ramon Margalef d'Ecologia 2018 a Steve Carpenter.** Fòrum científic i taula rodona, Aula

Magna Facultat de Biologia, Universitat de Barcelona. 19<sup>th</sup> December 2018.

Sabater, S. **"Effects of human-driven water stress on river ecosystems: from small to larger scales"**. Invited Plenary Lecture. *TerraEnvision Conference*. Barcelona, 29th Jan-2nd February 2018.

Sabater, S. **Water scarcity effects on river ecosystems. In: Managing water scarcity in river basins: innovation and sustainable development.** *Globalqua Conference*. Agadir, 4-6 October 2018.

## PATENTS/PILOT PLANTS

**Patente Española:** ES2490065

**Título:** *Sistema de monitorització de desbordaments en redes de tuberías.*

**Fecha de sol·licitud:** 27/02/2013 -- **Fecha de concepción:** 09/06/2015

**Titular:** Fundació Institut Català de Recerca de l'aigua (ICRA)

**Inventores:** Oriol Gutierrez García-Moreno; Lluís Corominas Tabares; Vicenç Acuña Salazar

**European patent application:** EP16382307. (Requested)

**Title:** *Method for operating a membrane bioreactor of a water treatment system and corresponding membrane bioreactor and water treatment system.*

**Holder:** University of Girona and the Catalan Institute for Water Research (ICRA).

**Inventors:** Blandin, Gaetan, Rodríguez-Roda Layret, Ignasi, Comas i Matas, Joaquim.







# 05 PROJECTS

- RESOURCES AND ECOSYSTEMS  
RESEARCH AREA**
- WATER QUALITY RESEARCH AREA**
- TECHNOLOGIES AND EVALUATION  
RESEARCH AREA**
- ICRA**



## RESOURCES AND ECOSYSTEMS RESEARCH AREA

<b>PROJECT</b>
<b>Transferencia de nanomateriales de carbono en el medio ambiente acuático (ERA-NET_NanoTransfer)</b>
Funding agency: Ministerio de Ciencia e Innovación
Duration: 2015-2018
Coordinator: Esteban Abad (IDAEA-CSIC)
Leader researcher: Sergi Sabater
Amount for ICRA: €90,000

<b>PROJECT</b>
<b>Managing the effects of multiple stressors on aquatic ecosystems under water scarcity (GLOBAQUA)</b>
Funding agency: European Commission FP7-ENV-2013 (603629)
Duration: 2014-2019
Coordinator: Consejo Superior de Investigaciones Científicas (CSIC)
Leader researcher: Sergi Sabater
Amount for ICRA: €637,551

<b>PROJECT</b>
<b>Estrategias de descontaminación de recursos hídricos basadas en la optimización de procesos de atenuación natural (REMEDIATION)</b>
Funding agency: Ministerio de Economía y Competitividad (MINECO). (CGL2014-57215-C4-2-R)
Duration: 2015-2018
Coordinator: ICRA
Leader researcher: Josep Mas-Pla
Amount for ICRA: €84,700

<b>PROJECT</b>
<b>Science and Management of Intermittent Rivers and Ephemeral Streams (COST_SMIREs)</b>
Funding agency: European Union – Cost Action
Duration: 2016-2020
Coordinator: Institut National de Recherche en sciences et technologies pour l'environnement et l'agriculture (IRSTEA).
Leader researcher: Vicenç Acuña Salazar
Amount for ICRA: €0

<b>PROJECT</b>
<b>Management of Climatic Extreme Events in Lakes Reservoirs for the Protection of Ecosystem Services (MANTEL)</b>
Funding agency: European Commission H2020-MSCA-ITN-2016 (722518)
Duration: 2017-2020
Coordination: Centre for Freshwater and Environmental Studies (IRL)
Leader researcher: Rafael Marce Romero
Amount for ICRA: €247,872.96

<b>PROJECT</b>
<b>Integration of climate seasonal prediction and ecosystem impact modeling for an efficient adaptation of water resources management to increasing climate extreme events (ERA4CS_WATExR)</b>
Funding agency: MINECO
Duration: 2017-2020
Coordination: ICRA
Leader researcher: Rafael Marce Romero
Amount for ICRA: €148,000

<b>PROJECT</b>
<b>Climate Alert Smart System for Sustainable Water and Agriculture (ERA4CS_CLIMALERT)</b>
Funding agency: MINECO
Duration: 2017-2020
Coordination: University of Minho
Leader researcher: Sergi Sabater
Amount for ICRA: €97,445

<b>PROJECT</b>
<b>Lagos manguantes y la remobilización de un sumidero de carbono milenario: impactos pasados, presentes y futuros en el carbono atmosférico (Eulnv_DRYsINK)</b>
Funding agency: MINECO
Duration: 2017-2018
Coordination: ICRA
Leader researcher: Rafael Marce Romero
Amount for ICRA: €3,815

<b>PROJECT</b>
<b>Intermitencia espacial y temporal del flujo en sistemas fluviales: efectos en la estructura, funcionamiento, y servicios ecosistémicos (Retos17_SPACESTREAM)</b>
Funding agency: Ministerio de Economía y Competitividad (MINECO) and ERDF.
Duration: 2018-2020
Coordination: ICRA
Leader researcher: Vicenç Acuña Salazar
Amount for ICRA: €96,800

<b>PROJECT</b>
<b>Dinámica del carbono en lagos y embalses frente a una hidrología cambiante: implicaciones para el metabolismo del ecosistema, flujos de gases y sumideros (Excel17_C-HydroChange)</b>
Funding agency: Ministerio de Economía y Competitividad (MINECO) and ERDF.
Duration: 2018-2020
Coordination: Universidad de Málaga
Leader researcher: Rafael Marce Romero
Amount for ICRA: €48,400

<b>PROJECT</b>
<b>Impacto de la contaminación de origen agrícola en la calidad hidroquímica (nitratos, antibióticos) y microbiológica (genes de resistencia) (Retos17_IMPACT)</b>
Funding agency: Ministerio de Economía y Competitividad (MINECO) and ERDF.
Duration: 2018-2021
Coordination: Universitat de Barcelona (UB)
Leader researcher: Josep Mas-Pla
Amount for ICRA: €104,665

<b>PROJECT</b>
<b>Assessing the fate of a long-term C sink: organic carbon LOSS in lake SEDiments as a consequence of recurrent and permanent drying (CLOSED) (BP2016_NCatalan)</b>
Funding agency: AGAUR
Duration: 2018-2019
Coordination: ICRA
Leader researcher: Rafael Marce Romero
Amount for ICRA: €92,000



## WATER QUALITY RESEARCH AREA

PROJECT	
<b>Acumulación, dispersión y eliminación de resistencias a antibióticos en colectores de agua residual (SEWAGENE-16)</b>	
Funding agency:	Ministerio de Economía y Competitividad (MINECO) and ERDF.
Duration:	2016-2019
Coordinator:	ICRA
Leader researcher:	Carles Borrego Moré
Amount for ICRA:	€154,880

PROJECT	
<b>Groundwater quality assessment in areas with intensive livestock: is manure recycling a major source of pollution and dissemination of antibiotic resistance genes? (RESOURCE)</b>	
Funding agency:	European Commission H2020-MSCA-IF-2016 (750104)
Duration:	2017-2019
Coordinator:	ICRA
Leader researcher:	Meritxell Gros, Supervisor Mira Petrovic
Amount for ICRA:	€170,121.6

PROJECT	
<b>New and emerging challenges and opportunities in wastewater reuse (NEREUS)</b>	
Funding agency:	European Union – COST Action - ES1403
Duration:	2014-2018
Coordinator:	University of Cyprus
Leader researcher:	Sara Rodríguez-Mozaz
Amount for ICRA:	€0

PROJECT	
<b>Como predecir y minimizar de la formación de NDMA en agua potable y reciclada mediante técnicas analíticas avanzadas (Retos17_NDMA_PREDICT)</b>	
Funding agency:	Ministerio de Economía y Competitividad (MINECO) and ERDF.
Duration:	2018-2020
Coordinator:	ICRA
Leader researcher:	Maria Jose Farre Olalla
Amount for ICRA:	€171,094

PROJECT	
<b>Interdisciplinary concepts for municipal wastewater treatment and resource recovery. Tackling future challenges (TreatRec)</b>	
Funding agency:	European Commission H2020-MSCA-ITN-2014 (642904)
Duration:	2015 - 2018
Coordinator:	ICRA
Leader researcher:	Mira Petrovic
Amount for ICRA:	€4,574,592

PROJECT	
<b>MicroPLASTicos y Microcontaminantes en la costa MEDiterranea. Toxicidad e Impacto ambiental y en la salud humana (Retos17_PLAS_MED)</b>	
Funding agency:	Ministerio de Economía y Competitividad (MINECO) and ERDF.
Duration:	2018-2020
Coordination:	CSIC (Marinella Farré)
Leader researcher:	Sara Rodríguez Mozaz
Amount for ICRA:	€159,720

PROJECT	
<b>Emerging contaminants in freshwaters: deciphering impact on aquatic macroinvertebrate metabolic response and ecosystem transfer (UKF_Croacia)</b>	
Codi oficial:	Grant Agreement no. 6/17
Duration:	2017-2019
Coordination:	University of Zagreb
Leader researcher:	Mira Petrovic
Amount for ICRA:	€0

PROJECT	
<b>SMART-WORKFLOW</b>	
Codi oficial:	European Commission H2020-MSCA-IF-2016
Duration:	2018-2020
Coordination:	ICRA
Leader researcher:	Mira Petrovic
Amount for ICRA:	€158,121.60



## TECHNOLOGIES AND EVALUATION RESEARCH AREA

<b>PROJECT</b>	
<b>Smart decentralized water management through a dynamic integration of technologies (JPI_Water2014_WATINTECH)</b>	
Funding agency:	Ministerio de Economía y Competitividad (MINECO)
Duration:	2016-2019
Coordinator:	ICRA
Leader researcher:	Ignasi Rodriguez-Roda Layret
Amount for ICRA:	€220,000

<b>PROJECT</b>	
<b>Tecnologías eficientes para la eliminación de contaminantes de preocupación emergente, contenidos en Directiva 2013/39/CE o de riesgo significativo según Directiva 2008/105/CE (TRICERATOPS)</b>	
Funding agency:	Ministerio de Economía y Competitividad (MINECO) y ERDF
Duration:	2016-2018
Coordinator:	ICRA
Leader researcher:	Wolfgang Gernjak
Amount for ICRA:	€175,450

<b>PROJECT</b>	
<b>Resiliencia de los sistemas de saneamiento a desafíos emergentes: de la generación de conocimiento a la mejora de la gestión integrada (ReACH)</b>	
Funding agency:	Ministerio de Economía y Competitividad (MINECO) y ERDF.
Duration:	2016-2018
Coordinator:	ICRA
Leader researcher:	Lluís Corominas Tabares
Amount for ICRA:	€123,420

<b>PROJECT</b>	
<b>Three-dimensional nanoelectrochemical systems based on low-cost reduced graphene oxide: the next generation of water treatment systems (ELECTRON4WATER)</b>	
Funding agency:	European Commission ERC-2016-STG (714177)
Duration:	2017-2022
Coordinator:	ICRA
Leader researcher:	Jelena Radjenovic
Amount for ICRA:	€1,493,733.12

<b>PROJECT</b>	
<b>Desarrollo de una herramienta avanzada de Gestión preventiva y para la Eficiencia de recursos hídricos en infraestructuras de Saneamiento uRbano (GESTOR)</b>	
Funding agency:	Ministerio de Economía y Competitividad (MINECO) y ERDF
Duration:	2016-2019
Coordinator:	Sociedad Fomento Agrícola Castellonense SA (FACSA)
Leader researcher:	Oriol Gutierrez Garcia Moreno
Amount for ICRA:	€221,445.48

<b>PROJECT</b>	
<b>Estudio preparatorio de proyecto I+D: NITRATES-SAD-CLOUD</b>	
Funding agency:	MINETUR
Duration:	2017-2018
Coordinator:	Catalan Water Partnership (CWP)
Leader researcher:	Joaquim Comas Matas
Amount for ICRA:	€3,007

<b>PROJECT</b>	
<b>ARC-Grant-WGE_Toxic metal removal from wastewater sludge</b>	
Funding agency:	INSTITUCIÓN PÚBLICA
Duration:	2017-2019
Coordinator:	Australian Research Council
Leader researcher:	Wolfgang Gernjak
Amount for ICRA:	€0

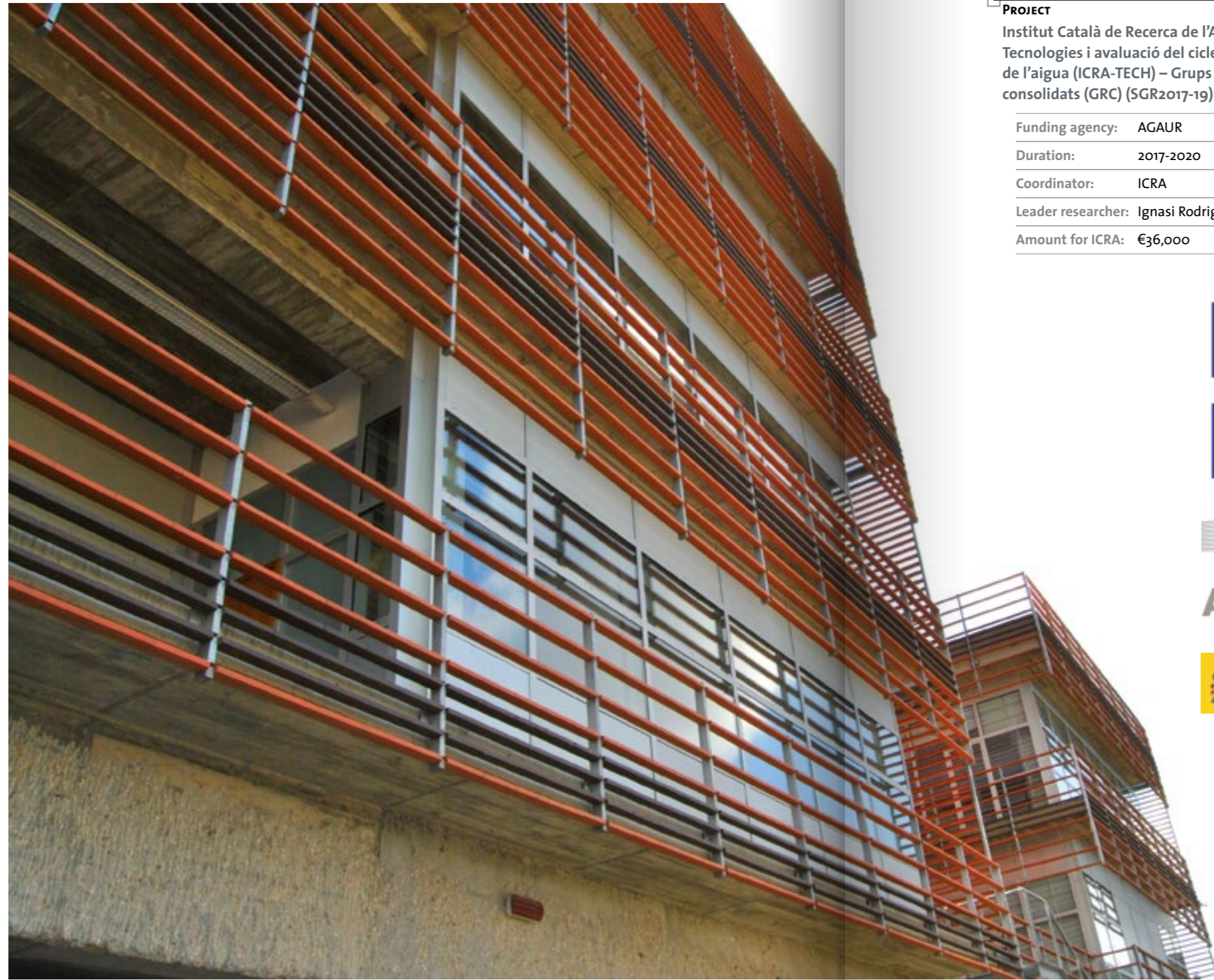
<b>PROJECT</b>	
<b>Gestión del ciclo urbano del agua (Eulnv_AQUACITY)</b>	
Funding agency:	Ministerio de Economía y Competitividad (MINECO)
Duration:	2017-2018
Coordinator:	ICRA
Leader researcher:	Joaquim Comas Matas
Amount for ICRA:	€20,000

<b>PROJECT</b>	
<b>Economía circular para facilitar la reutilización de agua urbana en una ciudad turística: gestión centralizada o descentralizada? (Retos17_CLEaN-TOUR)</b>	
Funding agency:	Ministerio de Economía y Competitividad (MINECO) and ERDF.
Duration:	2018-2020
Coordinator:	ICRA
Leader researcher:	Joaquim Comas Matas
Amount for ICRA:	€181,500

<b>PROJECT</b>	
<b>Nitrogen Extraction from Water By an Innovative Electrochemical System (life NEWBIES)</b>	
Funding agency:	European Commission LIFE17 ENV/NL/000408
Duration:	2018-2021
Coordinator:	WETSUS
Leader researcher:	Maite Pijuan Vilalta
Amount for ICRA:	€97,307

<b>PROJECT</b>	
<b>HYDROUSA</b>	
Funding agency:	European Commission CIRC-02-2017 (776643)
Duration:	2018-2022
Coordinator:	National Technical University of Athens
Leader researcher:	Gianluigi Buttiglieri
Amount for ICRA:	€474,300





# ICRA

**PROJECT**  
 Institut Català de Recerca de l'Aigua -  
 Tecnologies i avaluació del cicle integral  
 de l'aigua (ICRA-TECH) – Grups de recerca  
 consolidats (GRC) (SGR2017-19)

---

Funding agency: AGAUR

---

Duration: 2017-2020

---

Coordinator: ICRA

---

Leader researcher: Ignasi Rodriguez Roda Layret

---

Amount for ICRA: €36,000

**PROJECT**  
 Institut Català de Recerca de l'Aigua -  
 Qualitat, dinàmica i funció dels ecosistemes  
 aquàtics continentals (ICRA-ENV) – Grups de  
 recerca consolidats (GRC) (SGR2017-19)

---

Funding agency: AGAUR

---

Duration: 2017-2020

---

Coordinator: ICRA

---

Leader researcher: Mira Petrovic

---

Amount for ICRA: €60,216







# 06 CONTRACTS

TOTAL AMOUNT (2018):  
**€396,839.80**



## RESOURCES AND ECOSYSTEMS RESEARCH AREA


**CONTRACT:**

Sostenibilidad de Recursos Hídricos Bajo el Cambio Global - HIDSOS IV (HIDSOS-IV)

Contracting Entity: ENDESA

Duration: 2016-2019

Leader researcher: Sergi Sabater Cortes

## WATER QUALITY RESEARCH AREA


**CONTRACT:**

Contract: Presència d'antibiòtics i fàrmacs d'ús veterinari en dejeccions ramaderes: eliminació durant el tractament de nitrificació-desnitrificació, avaluació de la seva persistència en sòls agrícoles i transport cap a les aigües subterrànies (BETA\_FARMACS)

Contracting Entity: Granges Terragrisa

Duration: 2016-2018

Leader researcher: Mertixell Gros Calvo


**CONTRACT:**

Realització d'anàlitiqes d'antibiotics and pharmaceutical compounds (multi-residue analysis)

Contracting Entity: ITALPOLLINA

Duration: 2017-2018

Leader researcher: Mertixell Gros Calvo


**CONTRACT:**

Monitorización de formación de n-nitrosodimetilamina (ndma) en plantas de tratamiento del canal de Isabel II Gestión (Canal\_NDMA-2017)

Contracting Entity: Canal Isabel-II Gestión

Duration: 2018

Leader researcher: Maria Jose Farre Olalla

## TECHNOLOGIES AND EVALUATION RESEARCH AREA


**CONTRACT:**

Sustainable and Low Energy Wastewater treatment for Warm Climates (LIFE CELSIUS)

Contracting Entity: ACCIONA AGUA S.A.U.

Duration: 2017-2018

Leader researcher: Maite Pijuan Vilalta


**CONTRACT:**

Contrato de prestación de servicios técnicos especializados. Roquetas de Mar

Contracting Entity: CETaqua

Duration: 2016-2018

Leader researcher: Oriol Gutierrez Garcia Moreno

**CONTRACT:**

Contrato de prestación de servicios técnicos especializados. Castelldefels

Contracting Entity: CETaqua

Duration: 2016-2018

Leader researcher: Oriol Gutierrez Garcia Moreno

**CONTRACT:**

Convenio marco de colaboracion entre la Fundación Institut Català de Recerca de l'Aigua-ICRA y Soil Tratamiento de Aguas Industriales, S.L.

Contracting Entity: SOIL Agua S.A.

Duration: 2014-2019

Leader researcher: Oriol Gutierrez Garcia Moreno

**CONTRACT:**

Developing and supplying ecoinvent with a modelling tool for calculating and generating LCI for wastewater treatment activities, in the framework of the Sustainable Recycling Industries (SRI)

Contracting Entity: Polytechnique Montreal

Duration: 2017-2018

Leader researcher: Lluís Corominas Tabares

**CONTRACT:**

Seguiment analític de planta de Borrassa (DIPSALUT\_Borrassa)

Contracting Entity: DIPSALUT

Duration: 2017-2018

Leader researcher: Maite Pijuan Vilalta

**CONTRACT:**

Expansion of the too ECAM V2 with a reuse component (IWA-ECAM-reuse)

Contracting Entity: IWA

Duration: 2018

Leader researcher: Lluís Corominas Tabares

**CONTRACT:**

Desarrollo de una plataforma web y App para la asistencia a la operación EDARs, basada en criterios ambientales y ecosistémicos (EcoAdvisor for Wise Leadin Water Management) (EcoAdvisor)

Contracting Entity: Aigües de Catalunya

Duration: 2018-2020

Leader researcher: Lluís Corominas Tabares

**CONTRACT:**

Tasques d'actualització de l'eina ECAM pel projecte "Climate-Friendly Sanitation Services in Peri-Urban Areas of Lusaka Project, Lusaka, Zambia" (ECAM-GIZ-Lusaka)

Contracting Entity: GIZ

Duration: 2018

Leader researcher: Lluís Corominas Tabares

**CONTRACT:**

Contracte amb ACA per eliminació olors en Sistemes de sanejament Torredembarra – Creixell (H2S\_Torredembarra)

Contracting Entity: Agència Catalana de l'Aigua

Duration: 2018-2019

Leader researcher: Oriol Gutierrez Garcia Moreno

**CONTRACT:**

Estudio de la utilización de rechazos de potabilización ricos en NO<sub>3</sub> para el control de olores, toxicidad y corrosión en redes de saneamiento (FACSA\_Nules)

Contracting Entity: FACSA

Duration: 2018-2019

Leader researcher: Oriol Gutierrez Garcia Moreno



# 07 AGREEMENTS



09/02/2018

**ARIZONA STATE UNIVERSITY - ASU**

Agreement to handle the shipment of material to conduct analysis of antibiotic resistance.

04/04/2018

**AQuAS (SISTEMA D'INFORMACIÓ UNEIX)**

ICRA adheres to the agreement signed between the Government of Catalonia, through the Ministry of Economy and Health Knowledge, the I-CERCA Foundation and AquAS for maintaining the UNE Information System. Signed on 10 April 2015.

10/04/2018

**USCS (Univeridad Catolica de la Santisima Concepció)**

General Framework Agreement signed with the Universidad Católica de la Santísima Concepción (Chile) with the aim of establishing the framework for collaboration between ICRA and UCSC related to aspects of research, knowledge transfer and dissemination in the field of water resource management and the water cycle.

19/04/2018

**IWA (International Water Association)**

IWA has engaged ICRA to provide services for IWA in ECAM Tool (Energy and Carbon Assessment and Monitoring Tool) for the Water and Wastewater Utilities for Climate Mitigation (WaCClIM).

20/04/2018

**UNIQUEST**

Analysis services contracted from UNIQUEST (Queensland- Australia) by Oriol Gutierrez for the Roquetas, Palamos and Castelldefels projects.

21/04/2018

**Universitat de Lleida**

Addendum to the collaboration agreement between the University of Lleida and ICRA, signed on 22nd February 2011, setting out the special conditions for the collaboration of Dr Ramon Batalla, a lecturer at the UdL, as a contributor for the performance of the Hydrological Processes research strand in ICRA's Resources and Ecosystems Area.

05/06/2018

**Companyia Gral d'Aigües de Catalunya (CGAC)**

The purpose of this agreement is to co-develop a web platform and app for supporting WWTP operations based on environmental and ecosystem principles.

06/06/2018

**ARIZONA STATE UNIVERSITY – ASU**

Agreement to handle the shipment of material to conduct analysis of antibiotic resistance.

21/06/2018

**RIS<sub>3</sub>CAT- COMUNITAT AIGUA- EFLUCOMP**

Grouping Agreement for the implementation of the Project "Research on cost-efficient technologies based on separation, biological and other innovative processes for the treatment of complex effluents (EFLUCOMP)".

26/06/2018

**SCAN**

The objective of this agreement is to carry out the study of comparison of continuous performance of different pH combi probes under identical conditions in wastewater applications.

03/07/2018

**Universitat Illes Balears**

The purpose of the agreement is to establish the framework for regulating collaboration between the two institutions for potential internships outside ICRA: Curricular internships and extracurricular internships.

17/07/2018

**LEITAT-DEISA-CFC (RIS<sub>3</sub>CAT)**

Scientific collaboration agreement between all the institutions as part of the EFLUCOMP project. The agreement specifically sets out the conditions for CFC to authorise the EFLUCOMP project institutions to collect samples from its two treatment plants.

23/07/2018

**Comunitat Aigua- RIS<sub>3</sub>CAT**

Agreement to set up the RIS<sub>3</sub>CAT Water Community Consortium.

27/07/2018

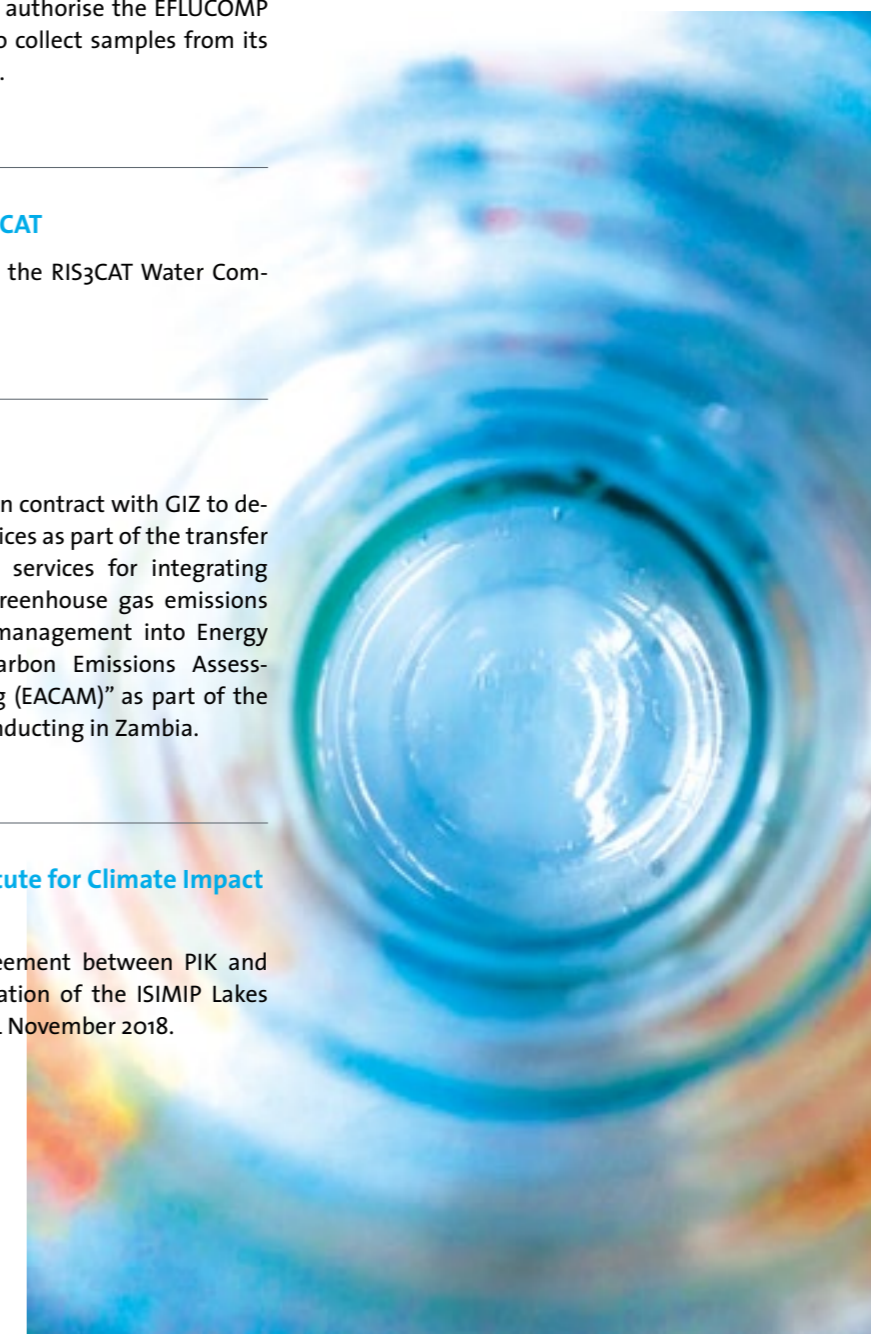
**GIZ**

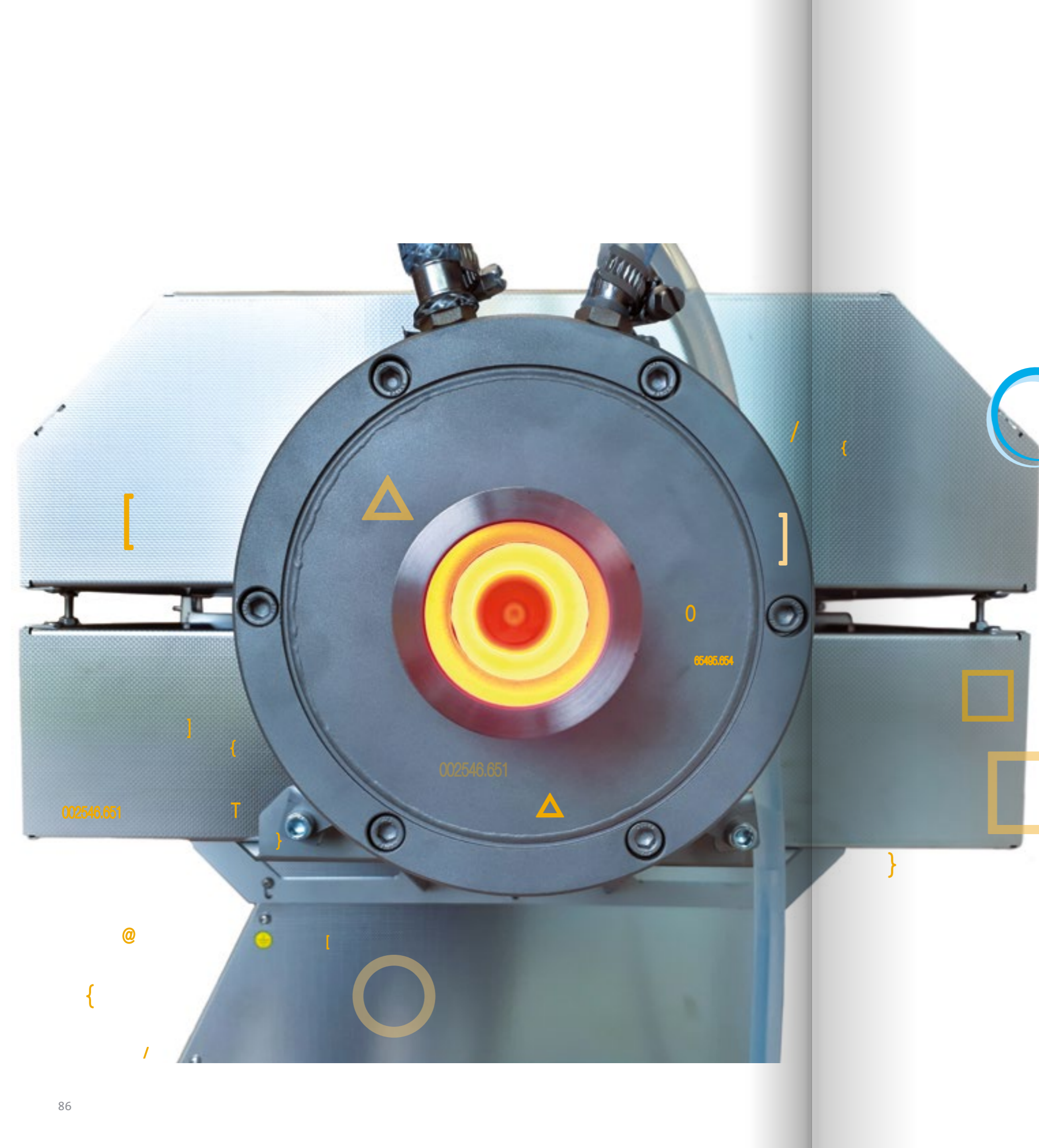
Scientific collaboration contract with GIZ to deliver consultancy services as part of the transfer project "Consultancy services for integrating the assessment of greenhouse gas emissions from faecal sludge management into Energy Performance and Carbon Emissions Assessment and Monitoring (EACAM)" as part of the programme GIZ is conducting in Zambia.

30/10/2018

**PIK (the Potsdam Institute for Climate Impact Research)**

Signature of an agreement between PIK and ICRA for the organisation of the ISIMIP Lakes sector workshop 12-14 November 2018.





# 08 OTHER DISSEMINATION ACTIVITIES

One of the foundational objectives of ICRA is promotion of activities that contributes to boosting research in water sciences and technologies.



29/01/2018

### TERRAenVISION Environmental Issues Today: Scientific Solutions for Societal Issues

Barcelona, Spain

ICRA participated in this conference which aims to focus on scientific research for finding solutions to the societal issues of our time. TERRAenVISION promotes interdisciplinary collaboration and networking, gathering scientists and stakeholders that have the same goal and work on the same societal issue but have different scientific backgrounds. By bringing the people and their knowledge together, we may be able to take the steps towards solutions that can take our society to a more sustainable situation. In this conference we seek to link to international policies such as the Sustainable Development Goals, the UN Climate conventions, CAP and COP.

The themes:

1. Climate change: Mitigation and Adaptation
2. Water Resources: Quality and Quantity
3. Land Degradation and Restoration
4. Nature based solutions
5. Fire in the earth system, effects and prevention
6. Ecosystem services and Health
7. Science interface: with policy and public

08/02/2018

### Careers Guidance Sessions

Faculty of Science, University of Girona

ICRA took part in the Career Guidance Sessions for students (JOP 2018), organised by the Faculty of Sciences. The aim of these sessions is to introduce Faculty of Science students to the world of research and work. Dr Sergi Sabater presents ICRA and the opportunities available in the field of water research.

19/02/2018

### 5th GLOBAQUA Training Course: Economics of Sustainable Water Management in accordance to the Water Framework Directive (WFD), the Millennium Ecosystems Assessment (MEA) and Sustainable Development Goals of the UN Agenda 2030

Athens, Greece

Under the auspices of the UN SDSN Greece ([www.unsdsn.gr](http://www.unsdsn.gr)).

The 5<sup>th</sup> GLOBAQUA training course on the Economics of Sustainable Water Management in accordance with the Water Framework Directive (WFD), the Millennium Ecosystems Assessment (MEA) and Sustainable Development Goals of UN Agenda 2030 took place on 19<sup>th</sup> and 20<sup>th</sup> February 2018 in Athens, Greece, under the auspices of the UN SDSN Greece ([www.unsdsn.gr](http://www.unsdsn.gr)).

The course introduced the basic principles of resource economics related to water with focus on the Water Framework Directive and the Millennium Ecosystems Assessment. Topics covered included: economic instruments for sustainable water management, market and non-market valuation techniques, uncertainty and risk implications for water management, the political economy of freshwater and participatory approaches to water management. The course drew heavily on practical examples from the GLOBAQUA project ([www.globaqua-project.eu](http://www.globaqua-project.eu)) and other water-related projects of ICRE8 ([www.icre8.eu](http://www.icre8.eu)), the UN SDSN Greece co-hosting institution. Participants were able to understand in depth the economics of water management and the implications for sustainable development. The course involved morning and afternoon theory and application sessions, seminars and keynote lectures. The workshop was envisioned for post-graduate students, researchers at any stage in their professional career, as well as water professionals interested in the economics of freshwater management and sustainable development.

Coordinator: the course was coordinated by Phoebe Koundouri, Professor of Economics and Econometrics, Athens University of Economics and Business (School of Economics) and the London School of Economics (CCCEP), Scientific Director of ICRE8, SDSN-Greece chair.



22/02/2018

### Info-day and proposals review; PRIMA, Eranet Waterworks and CDTI

ICRA

The UdG Water Campus hosted the session “Info-day and review of proposals; PRIMA, Eranet Waterworks and CDTI” on 22<sup>nd</sup> February 2018. This event was aimed at members of the Water Campus who are interested in learning about any of the calls that were on display or would like to review their proposal with a specialist CDTI technician. Project reviews were scheduled throughout the day. The conference was led by Dr Ignacio Rodríguez-Roda Layret, Scientific Director of the Water Campus and Head of the Technologies and Evaluation Area, and was attended by Ms María José Tomás, a CDTI technician, who gave a presentation on “Opportunities in PRIMA, ERANET WATERWORKS AND CDTI”.

18/03/2018

### ACS National Meeting & Expo Nexus of Food, Energy & Water

New Orleans, LA, USA

ICRA Director Dr Barceló attended the conference organised by the American Chemical Society with his participation in the annual meeting as a member of the association along with a presentation at the “Food, Energy & Water” conference.

20/03/2018

### Friends of Water Awards

Barcelona, Spain

Every year on the occasion of World Water Day, the Catalan Friends of Water Association presents the Water Awards which are intended to provide a non-monetary stimulus to all initiatives, actions or careers that are related to our commitment to improving the relationship of Catalans with water and their natural environment.

At the 2018 event, Dr Damià Barceló picked up this prize for his scientific engagement and career.

04/05/2018

### 32<sup>nd</sup> Eastern Canadian Symposium

Quebec, Canada

ICRA took part in this international symposium which brings together leading scientists and presents the latest research on water, water quality, water treatment, water management and water-related problems. It also hosts participants from industry, government agencies, etc.

The main topics of interest were:

- Water quality
- Wastewater and stormwater treatment
- Drinking water treatment
- Water management
- Social, economic and political issues related to water quality
- Hydrology associated with water quality
- Water and sustainable development
- Water and public health issues

13/05/2018

### SETAC Europe 2018 Rome sessions announcement under Track 3: Environmental Chemistry and Exposure Assessments: Analysis, Monitoring, Fate and Modelling

Rome, Italy

The ICRA's Director took part in this forum with the presentation **Analysis and Fate of Emerging Contaminants in soils, water and plants under wa-**

**ter scarcity Co-chairs: Damià Barceló, Yolanda Picó**

Summary: This session solicits contributions describing recent advances in knowledge on the different sources of emerging contaminants, their incorporation into soil and vegetables through irrigation or biosolids applications and their metabolism, accumulation and translocation. In particular, we welcome contributions that link previous aspects with the ecological effects they produced by reacting in the environment during repeated applications of wastewater and organic amendments in soil.



14/05/2018

### Universitat de Girona Rector's institutional visit

ICRA

The new University of Girona Rector's Office team visited ICRA and met with the management and UdG researchers who are currently attached to ICRA.

Attendees:

- Dr Quim Salvi, UdG Rector
- Dr Rosa Núria Aleixandre, Chair of the Social Council - UdG
- Dr Dolors Capellà, Vice-Rector for Research and Knowledge Transfer
- Dr Josep Calbó, Vice-Rector for Strategic Projects
- Dr Miquel Solà, Doctoral School Director - UdG
- Dr Damià Barceló, ICRA Director
- Dr Sergi Sabater, Researcher attached to the UdG (Resources and Ecosystems Area), ICRA Deputy Director

- Dr Ignasi Rodríguez-Roda, Researcher attached to the UdG (Technologies and Evaluation Area)
- Dr Carles Borrego, Researcher attached to the UdG (Water Quality Area)
- Dr Joaquim Comas, Researcher attached to the UdG (Technologies and Evaluation Area)
- Dr Josep Mas-Pla, Researcher attached to the UdG (Resources and Ecosystems Area)
- Mr Ivan Sánchez, ICRA Manager

21/05/2018

### Monterrey International Forum

Monterrey, Mexico

Dr Damià Barceló took part in one of the most important conferences in Latin America related to water resources. World-class experts gathered at this forum to discuss the challenges and regulation of water policies on this continent.



28/05/2018

### Scientific Committee 2018

In 2018 the Committee met at its two-yearly session on 28-29 May. On the first day all the researchers presented their work over the last two years. At these sessions, the ICRA's management in conjunction with the senior researchers presented a proposal for a new ICRA Strategic Plan 2018-2021. On the last day, the Scientific Committee presented a document with its considerations and recommendations for the proposed Strategic Plan presented by ICRA, which also included recommendations on the direction of future project proposals.

31/05/2018

### CERCA Conference 2018

Barcelona, Spain

ICRA took part in the annual CERCA conference which brings together the main representatives of all the CERCA centres to discuss strategic aspects of interest for the evolution of the centre system. This time round the event focussed on the collaborative measures that are carried out by the centres.

This conference was attended by Dr Chaejun SONG, Director of Research and Development of the National Research Council of Science & Technology of Korea.

03/06/2018

### LC-QTOF MS for Trace Analysis of Pharmaceuticals in Wastewater Reuse, Soils and Plants: Identification of 46 Ibuprofen Metabolites in Roots, Shoots and Seeds of Cowpea (ASMS – DBA Congress)

San Diego, CA

As an international member of the American Society for Mass Spectrometry, Damià Barceló annually attends the meetings organised by the association as part of a congress with specific themes chosen each year by the association's members. In 2018 the theme was "Analysis of Pharmaceuticals in Wastewater Reuse, Soils and Plants: Identification of 46 Ibuprofen Metabolites in Roots, Shoots and Seeds of Cowpea".

13/06/2018

### Final TreatRec Conference Interdisciplinary concepts for municipal wastewater treatment and resource recovery. Tackling future challenges

ICRA

ICRA organised the "Final TreatRec Conference Interdisciplinary concepts for municipal wastewater treatment and resource recovery. Tackling future challenges". The Conference was held on 13-14 June 2018 in Girona, Spain.

The Conference was open to non-TreatRec members. Proposals for oral and poster presentations were welcome and were reviewed by the Organising Committee.



26/06/2018

**14<sup>th</sup> Annual LC-MS/MS workshop on environmental applications and food safety**

Barcelona, Spain

Together with IDAEA-CSIC, ICRA organised the 14<sup>th</sup> Annual LC-MS/MS workshop on environmental applications and food safety that was held on 26-27 June 2018 in Barcelona, Spain.

Full information can be found at the workshop's website: <http://www.idaea.csic.es/barcelona2018>

30/06/2018

**Smartphone analysers for on-site testing of food quality and safety**

Prague, Czech Republic

The major science and innovation gaps to be addressed by the FoodSmartphone project relate to high-speed and novel biorecognition of food contaminants, novel optical and electrochemical detection schemes in conjunction with smartphones, simplified microfluidic sample handling solutions that enable non-expert operation, advanced software architecture and the development of application demonstrators for food quality and safety issues of concern, viz. for antibiotics, pesticides, allergens, mycotoxins, food spoilage and marine toxins. Currently, most of our early stage researchers (ESRs) have completed their first year of research and complementary skills training and all of them presented their progress, challenges and plans at the annual full consortium meeting in Prague on 20th June 2018. Inevitably at this stage, most of them are still working with well-defined model systems without multiplexing or real-life application, but the progress in the right direction became very obvious from their exciting presentations. Very valuable suggestions and feedback were provided by experts from both the Supervisory Board as well as the Advisory Board of the FoodSmartphone project.

03/07/2018

**Doctoral thesis viva: "Factors affecting the distribution, abundance and diversity of uncultured archaeal groups in freshwater sediments"**

ICRA

This thesis studied the archaeal communities in freshwater sediments and related them in terms of abundance and composition with several en-

vironmental variables and pollution levels. It also determined the response of various lineages to supplementation with organic compounds.

By: Sergi Compte Port

Thesis supervisor: Dr Carles Borrego Moré

12/07/2018

**2<sup>nd</sup> Pharmaceutical Profession Summer Conference**

Puigcerdà

Dr Sara Rodriguez-Mozaz, an ICRA Researcher, took part in this conference organised by the Girona Pharmacists Association.



12/07/2018

**HYDROUSA kick-off meeting: Demonstration of water loops with innovative regenerative business models for the Mediterranean region**

Lavrion, Greece

In total 86 participants from the 27 project partners joined the meeting including ICRA (Gianluigi Buttiglieri and Ignasi Rodriguez-Roda) and CWP (Xavier Amores and Sara Gabarron).

The objectives of the kick-off meeting were:

- The introduction of HYDROUSA partners
- The presentation and discussion of work packages (WPs) and tasks
- The project management plan, reporting obligations, data management plan, next meetings, financial reporting and internal communication means
- The steps to the successful implementation of milestones and deliverables



24/07/2018

**PhD presentation: Influence of anthropogenic pollution on the prevalence, maintenance and spread of antibiotic resistance in aquatic microbial communities**

ICRA

By: Jessica Subirats Medina

Thesis supervisors: Dr Carles Borrego Moré (UdG-ICRA) and Dr Jose Luis Balcázar (ICRA)

You can see the abstract of the doctoral thesis here.

Date: Tuesday 24th July 2018

Time: 11.30 am

Venue: ICRA Building Auditorium.

(University of Girona Science and Technology Park)

Antibiotic resistance (AR) is the ability of bacteria to survive and grow in the presence of antibiotics. AR is responsible for 700,000 deaths per year worldwide and is considered a global public health problem. In recent decades, the abuse and misuse of these drugs have accelerated the evolution and spread of antibiotic resistance genes (ARGs) among pathogenic bacteria, thereby reducing their therapeutic efficacy. The environment is not immune to this problem because many aquatic systems (e.g. rivers and lakes) receive wastewater containing a wide variety of pharmaceutical residues, antibiotic-resistant bacteria and ARGs of both animal and human origin. In the environment, these contaminants may interact with the resident microbiota thus facilitating the spread of AR. This paper has studied the main factors which contribute to maintaining and disseminating AR in bacterial communities in aquatic environments affected by anthropogenic pollution.

This thesis demonstrates that microorganisms from wastewater are the main factor involved in

distributing AR in the natural environment and that background pollution by antibiotics and other drugs establishes optimal conditions for its accumulation and dissemination among resident microbial communities. It also shows that nutrients, in combination with emerging pollutants, work in synergy to stimulate the spread of some ARGs in bacterial communities. Our results suggest that biofilms from the river bed are useful as biosensors of the impact of wastewater discharges on the prevalence of AR in surface water. Finally, this thesis also furnishes results proving that bacteriophages (viruses that infect bacteria) accumulate ARGs and therefore may play an important role in the dissemination of AR in aquatic environments.

29/08/2018

**10<sup>th</sup> Recipharm International Environmental Award**

Stockholm, Sweden

On Tuesday 28<sup>th</sup> August, Recipharm awarded Karen Kidd with the 10<sup>th</sup> Recipharm International Environmental Award. The award acknowledges the best environmental practices or innovations within the pharmaceutical and healthcare industries or academia.

Karen Kidd is Professor of Biology, Geography & Earth Sciences at McMaster University, Hamilton, Canada. Dr Kidd's research aims to understand the effects of human activity – food production, natural resource extraction, urban environments – on the health of freshwater and marine ecosystems.

To recognise the award, Recipharm hosted a workshop together with the Stockholm International Water Institute (SIWI) at World Water Week.

The workshop included the prize-giving cere-

mony for the Recipharm International Environmental Award 2017 and an overview of regulatory developments in the area of environmental health by Hannah Leckie from the OECD. Karen Kidd also presented her own research and conclusions. In addition, previous award winners Alistair Boxall (University of York), Damia Barcelo (Catalan Institute for Water Research), Jerker Fick (Umeå University), Klaus Kummerer (Freiburg University) and Apoteket AB, represented by Erik Thorsell, participated in panel discussions to explore the impact of current research and regulatory developments.

04/09/2018

### CRETE 2018 International Conference- 6th International Conference on Industrial & Hazardous water Management

Chania - Crete, Greece

Dr Damià Barceló represented ICRA at this year's meeting as a member of its Scientific Committee.

26/09/2018

### SETAC Europe 24<sup>th</sup> LCA Symposium

Vienna, Austria

The focuses of this three-day symposium were case studies and the application of LCA linked to primary and secondary resources.

Contributions were sought on:

- Agricultural production systems and aquaculture systems
- Wood
- Infrastructure and mobility
- Waste, WEEE, food waste, industrial waste stream
- Building and construction
- Energy
- Labelling, EPD, footprinting, streamlined assessments
- Assessments of products, services and organisations
- Software, tools and databases
- PhD news corner: What do PhD students currently worked on?
- Circular economy and LCA: how can LCA support circular economy?
- How to assess multiple and cascading uses?
- Any other related topics

04/10/2018

### Brazil delegation visit

ICRA

ICRA received the institutional visit of representatives from several Brazilian institutions related to water who are interested in ICRA's management model. Alexandra Heschke: Technical Coordinator - CGEE (Center for Strategic Studies and Management, Brasilia), Isadora Freire: Operational Coordinator - Recife Pilot (Porto Digital, Recife), Guilherme Wiedman: National Director (Ministry of Science, Technology, Innovation and Communication, Brasilia)



12/10/2018

### ICRA attends XENOWAC 2018

Limassol - Cyprus

Dr Sara Rodriguez, Dr Carles Borrego, Dr Wolfgang Gernjak and Dr Gianluigi Buttiglieri from ICRA were at the 2018 XENOWAC congress in Limassol, Cyprus.



24/10/2018

### Annual meeting of the CRAES International Scientific Advisory Committee (ISAC)

Beijing - China

Dr Damià Barceló was invited to join the international Scientific Advisory Committee of the Chinese Research Academy of Environmental Sciences in an official ceremony held in Beijing, coinciding with the 1st International Conference on Environmental Sciences and Technologies and the 1st Inaugural Plenary Meeting of iSAC with its all members.

24/10/2018

### PhD presentation: Elimination of micropollutants in conventional and novel nitrogen removal processes. A comparative assessment of diverse microbial communities' capabilities

Science and Technology Park, University of Girona

By: Elissavet Kassotaki

Thesis supervisors: Dr Maite Pijuan Vilalta (ICRA), Dr Gianluigi Buttiglieri (ICRA) and Dr Ignasi Rodriguez-Roda Layret (Department of Chemical Engineering, Agriculture and Agri-Food Technology).

Micropollutants are organic compounds present in very low concentrations (from a few ng/L to several µg/L). This class of compounds includes a wide variety of anthropogenic and natural substances, such as pharmaceutically active compounds (PhACs), personal care products, endocrine disrupting compounds (EDCs), illegal drugs

and other industrial chemicals such as pesticides, flame retardants and surfactants. These compounds have recently emerged as a threat and challenge to the scientific community as they can pose a considerable risk to the environment and human health, adversely impacting their wellbeing. However, regulating these compounds is not easy and a legal framework has not yet been established to regulate them in drinking water, wastewater and/or reused water. In fact, the diversity of PhACs and EDCs and their continuous transformation both in the human body and during wastewater transport and treatment makes it difficult to detect them and evaluate their toxicological significance. Likewise, their release into the environment is not especially supervised and monitored. One of the main points of concern which exacerbates the problem is the fact that wastewater treatment plants (WWTPs) are not efficient barriers to the release of micropollutants and have been identified as the main points of their discharge and pollution of the aquatic environment. Consequently, the fate of PhACs and EDCs along with their degree of elimination in treatment systems are at the core of current research.

Against this backdrop, this thesis aims to determine the fate of five PhACs (ibuprofen, sulphamethoxazole, metoprolol, carbamazepine and venlafaxine) and five EDCs (oestrone, 17β-oestradiol, oestriol, 17α-ethinylestradiol and bisphenol A) in various treatment systems that simulate wastewater treatment scenarios to identify key factors in their elimination. Benchmarking was performed to determine the contribution of several bacterial groups (autotrophs or hete-



rotrophs) present in treatment systems at the laboratory, pilot and large scale which perform various processes in the elimination of the selected compounds. The experiments carried out have identified critical factors that are related to the elimination of the PhACs and EDCs studied and, consequently, to the effectiveness of selected technologies. It has also been observed that the biodegradability of compounds can be a relatively accurate indicator of total elimination. Ibuprofen, 17 $\beta$ -oestradiol and oestriol - generally biodegradable compounds - have been largely eliminated (up to 100%, 100% and 78%, respectively) under most of the conditions applied.

Conversely, carbamazepine, venlafaxine, 17 $\alpha$ -etinylestradiol and bisphenol A, which have been identified as persistent compounds, generally present low eliminations (<20% in most cases) in spite of the various conditions, treatment technologies and types of biomass used. Finally, moderately biodegradable compounds (sulphamethoxazole, metoprolol and oestrone) have shown increased dependence on specific experimental factors such as redox conditions, nitrification rate and the unique capabilities of each biomass. Overall, the results of this thesis indicate that the fate of PhACs and EDCs cannot be easily predicted due to the large variability across facilities, in operating conditions and thousands of existing compounds. However, the overall efficiency of wastewater treatment systems can be enhanced by combining different aerobic and anaerobic conditions and different types of biomass.

24/10/2018

### PhD presentation: Transport, distribution, and the fate of emerging contaminants in wastewater receiving rivers under multiple stress conditions.

ICRA

By: Ladislav Mandaric

Thesis supervisors: Dr Mira Petrovic and Dr Sergi Sabater

Date: Wednesday 24 October 2018

Time: 11 am

Venue: Auditorium at the Catalan Institute for Water Research - ICRA (University of Girona Science and Technology Park)

Pharmaceutically active compounds (PhACs) are some of the emerging contaminants of anthro-

pogenic origin continuously entering the aquatic environment. Their unremitting influx makes them into pseudo-persistent pollutants, i.e. the transformation and removal rates are offset by their continuous discharge into the environment. Once released into the aquatic environment, a number of processes decide their fate and transport. The most important attenuation processes that form the drainage network are biodegradation, abiotic oxidation and hydrolysis, photolysis, adsorption/desorption, dissolution, volatilisation and dispersion. However, the relative importance of these processes depends on the rates associated with natural environmental conditions. These rates in turn depend on the chemical structure and properties of the substance and its distribution in the various compartments of the environment. Consequently, understanding the transport, distribution and fate of PhACs is a prerequisite for thorough risk assessment in rivers that are receiving wastewater and subject to multiple stresses. As one of the multiple stressors in the Mediterranean aquatic environment, water scarcity has direct and indirect effects on the distribution and fate of PhACs.

The main purpose of this thesis was to establish a connection between the urban origin of chemical pollution (e.g. PhACs) and other stressors particularly associated with water scarcity (chapters 1, 2 and 3). The research was carried out in an alpine river (Chapter 1) and two Mediterranean basins (Chapters 2 and 3). The effects of the variability of fluvial flow on the recovery potential of the rivers (natural attenuation) were studied in rivers in the lower Ebro (Chapter 2) and the River Evrotas (Chapter 3). The results show the emergence and spatial-temporal distribution of PhACs in the fragile alpine and Mediterranean aquatic environments subjected to strong intra-annual variability of flow, while the effects of multiple stress conditions may be magnified under water scarcity conditions, fostering higher concentrations of PhACs in water and sediments. The increased residence time of PhACs during low flow conditions in intermittent rivers and streams in the Mediterranean region contributes to higher PhAC attenuation.

06/11/2018

### “Sequence analysis for microbial ecology” workshop

Barcelona, Spain

15/11/2018

### Iwater 2018: Demonstration of water loops with innovative regenerative business models for the Mediterranean region

Barcelona, Spain

Gianluigi Buttiglieri, a research scientist at ICRA, participated in Iwater 2018 on 13-15 November 2018, and presented the HYDROUSA project (Demonstration of water loops with innovative regenerative business models for the Mediterranean region).

HYDROUSA was one of the 5 finalist projects in the “Iwater Project Award 2018” category at the Iwater 2018 Awards.

More information at: <http://www.iwaterbarcelona.com/en/iwater-awards>

21/11/2018

### Expert Advisory Panel: El Prat de Llobregat Water Reclamation Plant ACA

Barcelona, Spain

ICRA joined the expert committee for the Water Reclamation Plant's Panel of Experts. The Catalan Water Agency organised the event which was attended by Secretary of Environment and Sustainability Marta Subirà and Secretary of Public Health Joan Guix in the Catalan Government, along with Deputy Chair of the Barcelona Metropolitan Area Environment Unit Eloi Badia and Catalan Water Agency Director Jordi Agustí. They presented the scientific advisory panel that is to analyse the use of reclaimed water as a structural measure to increase water availability in the Barcelona metropolitan area.

Summary of the press release:

The committee of experts held its first meeting today and is made up of a total of 12 members with a long research track record and experience in the water cycle on topics including microbiology, microbial diversity and reuse.

Marta Subirà highlighted the importance of reclaimed water and the promotion of reuse as a “strategic plank in the sustainable water management model and in line with the circular economy and the principles of the Water Framework Directive that the Catalan Government is promoting.” She also underscored “the valuable input and technical precision that this expert committee will bring to the reuse project, and both the Government of Catalonia and the Metropolitan

### Area would like to thank them for their generous support.”

The Secretary of Public Health pointed out that this project builds the preventive approach into managing hazards for health and the environment in line with the World Health Organisation's standards and as specified in the Catalan Public Health Act 18/2009 of 22 October. It does this by ensuring that prior risk assessment is conducted and appropriate management measures are put in place to ensure water safety and user confidence.

Eloi Badia, Deputy Chairman for Environment at the BMA, noted “the importance of this plant, which is part of the BMA's policy of making the most of its own resources so as not to be reliant on external basins. We are looking for our own solutions.”

### Increasing water availability

The Barcelona Metropolitan Area is currently supplied from three sources: groundwater, surface water and desalinated water. Although these solutions fully meet demand, new measures are needed to enhance this service which must also be nearby and efficient.

Reuse is one of the paths that still have some way to go. The Llobregat wastewater treatment plant has a facility, the Water Reclamation Plant or WRP, which applies more advanced treatment to already purified water.

During the 2016-2017 drought, consideration was given to using reclaimed water in the final stretch of the River Llobregat so as to increase the river's flow and thus provide more water for drinking. This solution was not implemented as it could only be brought into play if the Ter Llobregat system reservoirs fell to below 25% capacity.

At present reclaimed water is supplied to the Llobregat delta aquifer to provide a barrier to stop possible saline intrusion under an agreement between the CWA and the BMA signed in early 2018. This preserves a strategic reserve for the Barcelona area which is critical in times of drought.

### One step further

The purpose of setting up the committee of experts is to analyse the feasibility of using this solution on a more ongoing basis and outside periods of drought. This would provide a structural measure adding to the current sources of supply, thus enhancing the water security and self-sufficiency of the Barcelona area. The first measure carried out in today's session was to analyse the design of the analytical demonstration campaign.

23/11/2018

**Meeting of directors of water research centres in Spain**

Barcelona, Spain

ICRA took part in this conference with the attendance of its Director Dr Damià Barceló. The event brought together water centres from all over Spain at a forum where they presented their work strands and it has made it possible to build synergies between research groups and options for joint collaboration in preparing new National Plan and especially European projects.

10/12/2018

**Conference: AI-H<sub>2</sub>O: The challenge of integrated water management in the new world of the infosphere**

Science and Technology Park, University of Girona

This conference organised by the Water Campus was a debate on the impact of artificial intelligence on the management of the water cycle. The main challenges and scenarios emerging with the incorporation of artificial intelligence into data gathering, management and processing throughout the water cycle was discussed with water industry companies and experts in terms of both resource management (supply and quality) and business models.



18/12/2018

**GLOBAQUA Final Conference: Water river management under water scarcity and multiple stressors**

Barcelona, Spain

This interdisciplinary conference is a platform for exchange and discussion of innovative scientific findings and methods in aquatic ecosystems research. It focuses on the main results of the project after five years, results generated under four topics: STRESSORS (understanding the mechanisms behind the multiple stressors acting in each case study), RECEPTORS (analysing the effects of the stressors on biodiversity and ecosystem functioning), IMPLICATIONS (studying the implications for ecosystem services and socio-economy) and MANAGEMENT & POLICY (dealing with relevant issues associated with the impact of multiple stressors on water quality, quantity and ecosystems, as well as on the potential implementation of the major findings on European policy).

**SEMINARS ORGANISED BY ICRA AS PART OF THE SCIENCE DISSEMINATION PROGRAMME**

24/01/2018

**Seminar: Bioactivation of biochar with extracellular enzymes induced by earthworms**

ICRA

Dr. Juan C. Sánchez-Hernández, Universidad de Castilla-La Mancha, Toledo.

**Abstract:** Earthworms are an important fraction of soil biomass and play an important role in the decomposition of organic matter. In an ecotoxicological context, these invertebrates have been excellent partners in the process of assessing the toxicity of environmental pollutants. Recently some studies have pointed to the possibility that these organisms contribute to the degradation of organic pollutants by stimulating soil microorganisms, thus increasing the production of extracellular enzymes. Our studies have used this stimulating capacity to activate biochar (solid material generated by pyrolysis of biomass) with extracellular enzymes of biogeochemical and detoxifying interest and thus increase its persistence in the soil. In this talk we present the preliminary results of laboratory

experiments carried out with various types of biochar incubated in the presence of the earthworm *Lumbricus terrestris*. In particular, the findings obtained with enzymatic activity of environmental interest in the metabolism of organophosphate pesticides, and recently involved in the degradation of plastic polymers, will be presented. This functional interaction between earthworms and biochar provides a range of low-cost biotechnological possibilities with the aim not only of improving soil quality, but also of reducing the toxicity of contaminated soils and... perhaps also water?

16/02/2018

**Seminar: Building bridges between biogeochemistry and microbial ecology to understand the fate of pollutants in aquatic ecosystems: the case of mercury.**

ICRA

Dr Andrea G. Bravo, Institut de Diagnosi Ambiental i Estudis de l'Aigua (IDAEA-CSIC).



01/03/2018

**Seminar: Nanobiosensors for diagnostics, Prof Dr Arben Merkoçi, ICREA Professor and leader of the Nanobioelectronics & Biosensors Group, Institut Català de Nanociència i Nanotecnologia (ICN2).**

ICREA, Barcelona, Spain

Prof Dr Arben Merkoçi, ICREA Professor and leader of the Nanobioelectronics & Biosensors Group, Institut Català de Nanociència i Nanotecnologia (ICN2).

Abstract: There is high demand to develop innovative and cost-effective devices with interest for healthcare beside environment diagnostics, safety and security applications. The development of such devices is strongly related to new materials and technologies in which nanomaterials and nanotechnology have a special role. We study how new nanomaterials such as nanoparticles, graphene and nano/micromotors can be integrated in simple sensors thanks to their advantageous properties. Beside plastic platforms, physical, chemical and mechanical properties of cellulose in both micro and nanofiber-based networks combined with their abundance in nature or easy to prepare and control procedures are making these materials of great interest while looking for cost-efficient and green alternatives for device production technologies. Both paper and nanopaper-based biosensors are emerging as a new class of devices with the objective to fulfil the World Health Organisation requisites to be ASSURED: affordable, sensitive, specific, user-friendly, rapid and robust, equipment free and deliverable to end-users. How to design simple paper-based biosensor architectures? How to tune their analytical performance upon demand? How can we couple nanomaterials such as metallic nanoparticles, quantum dots and even graphene with paper and what is the benefit? How we can make these devices more robust, sensitive and with multiplexing capabilities? Can we bring these low cost and efficient devices to places with low resources, extreme conditions or even our homes? What are the perspectives for linking these simple platforms and detection technologies with mobile communication? I will try to give responses to these questions through various interesting applications related to protein, DNA and even contaminant detection, all of extreme importance for diagnostics, environment control, safety and security.

13/04/2018

**Seminar: Research and innovation in water management at Mas Badia Agricultural Experimental Station**

ICRA

Joan Bonany, IRTA-Mas Badia Director and Francesc Camps, IRTA-Mas Badia Researcher

13/04/2018

**Seminar: RDT activities in the efficient use of water in agriculture**

ICRA

Jaume Casadesús, Researcher, Water Efficiency in Agriculture Programme – IRTA, Lleida

20/04/2018

**Seminar: CREAM; towards excellence in generating new conceptual and methodological tools for the conservation, management and adaptation of the environment to global change**

ICRA

CREAF researchers

23/05/2018

**Seminar: Species target management of water blooms – success story of Brno reservoir**

ICRA

Prof Dr Blahos Marsalek, University of Brno.

30/05/2018

**Seminar: Assessment of the ecological health of the Willamette River, USA**

ICRA

Prof Dr Stanley V. Gregory, Oregon State University.

Abstract: The lecture will describe our collective efforts to develop a “report card” for the Willamette River based on ecological trends that are relevant to the citizens of the Willamette River basin, and that had given way to a long-term monitoring program for the Willamette, with the associated challenges for funding and coordination.

19/06/2018

**Seminar: From Target to Non-Target Screening: Comprehensive Characterization of water systems using LC-HRMS/MS**

ICRA

Dr Pablo Gago Ferrero, Postdoc Researcher (MSC Marie-Curie) Water Quality

05/07/2018

**Seminar: Manmade ecosystems, nitrogen (NO<sub>x</sub>), methane and impossible microbes**

ICRA

Simon Guerreo, Microbiology Department, Radboud University, Nijmegen, Netherlands.

08/10/2018

**Seminar: Chemicals and wildlife: the missing link?**

ICRA

Prof Dr Andrew C. Johnson, Centre for Ecology and Hydrology, UK.

20/11/2018

**Seminar: Pore-scale origins for preferential pathways in multiphase & reactive flows**

ICRA

Dr Ran Holtzman, The Hebrew University of Jerusalem (currently on sabbatical at IDAEA-CSIC).

30/11/2018

**Seminar: Membrane catalytic Reactors – fighting for surface and reactivity**

ICRA

Prof Dr Ludovic Dumée, PhD, ARC DECRA Senior Research Fellow, Institute for Frontier Materials.

11/12/2018

**Seminar: Emerging contaminants in freshwaters: deciphering impact on aquatic macroinvertebrate metabolic response and ecosystem transfer.**

ICRA

Ana Previsic, Department of Biology, Faculty of Science, University of Zagreb, Zagreb, Croatia. Marko Rozman, Ruđer Bošković Institute (RBI), Zagreb, Croatia.

Abstract: We present an ongoing project aimed at advancing our knowledge on bioaccumulation of PhACs and EDCs in aquatic organisms and aquatic-terrestrial food web coupling. In order to achieve this, we combined field-based research (in situ collections) and laboratory mesocosm experiments with selected macroinvertebrate taxa (aquatic insects). Preliminary results show dynamics of a whole body EDC concentration throughout the life cycle of aquatic insects, i.e. in all life stages, and provide novel insights into contaminants' ecosystem transfer.

18/12/2018

**Seminar: The research profile of a global company leader in UV technologies**

ICRA

Dr Domenico Santoro, Trojan UV, Canada.

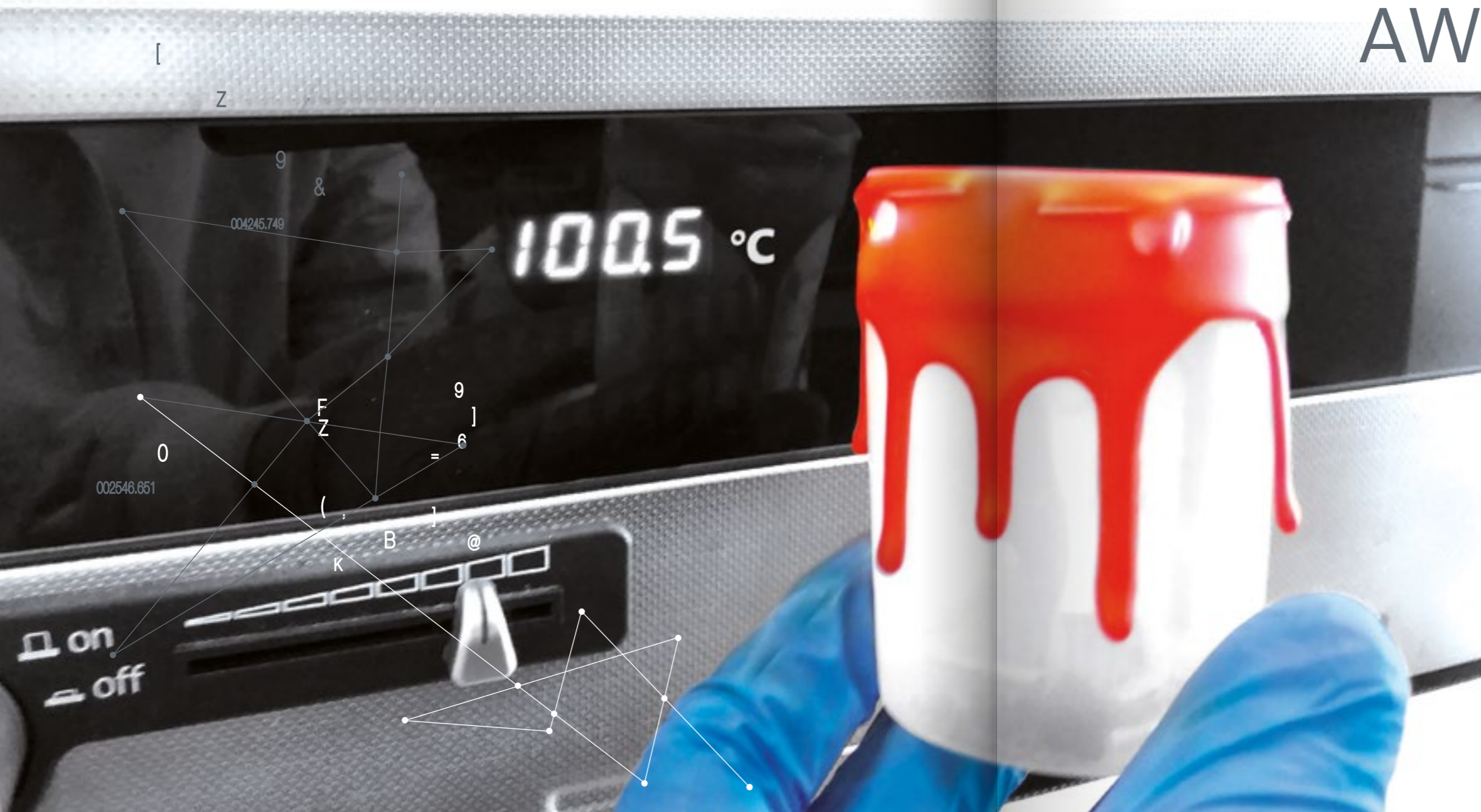
18/12/2018

**Seminar: The Water-Chemistry nexus**

ICRA

Prof Korneel Rabaey, University of Ghent, Belgium

# 09 AWARDS



## HYDROUSA project at Iwater 2018 Awards

HYDROUSA (demonstration of water loops with innovative regenerative business models for the Mediterranean region) was one of the 5 finalist projects in the “*Iwater Project Award 2018*” category at the Iwater 2018 Awards.





# 10 FINANCING

## Contribution of the Regional Government of Catalonia

Ministry of Business and Knowledge (DECO)	€1,812,000.00
Catalan Water Agency (ACA)	€400,000.00
<b>COMPETITIVE PROJECTS</b>	
Regional Government of Catalonia	€145,970.42
Ministry of Economy and Competitiveness	€830,245.66
European Union	€696,477.26
<b>TRANSFER PROJECTS</b>	
Knowledge Transfer Technology (KTT)	€200,997.07
Financial income	€30,868.45
Other income	€8,677.80
<b>TOTAL INCOME</b>	<b>€4,125,236.66</b>

The **University of Girona** as ICRA Trustee annually consolidates its non-monetary contribution to ICRA from the transfer of the researchers assigned to its investigation, which is financially measured by the UdG in the amount of €305,046.72 for 2018.







ICRA has also committed to social networks over this last year. On Twitter (@icrawater) it now has 347 more followers, reaching 973 followers in December 2018, a total of 631 likes and 319 retweets to its tweets.

During 2018, ICRA uploaded to its YouTube channel a self-created video entitled "Globaqua Final Conference. 19 December 2018, Barcelona" that obtained 30 views, and the video "Diàlegs de l'Aigua del TEDxUdG amb Ignasi Rodríguez-Roda i Samuel Reyes. October 2018" that achieved 150 views.

Moreover, the video "10. TICCC a Manresa: Ecosistemes aquàtics continentals - Dr. Sergi Sabater (UdG—ICRA)" was shared.

The topic "Globaqua" was added to the list of the 7 already existing ones.

- Contaminants emergents: 2 videos
- Aigua i canvi climàtic: 1 video
- "The drops of Damià Barceló": 5 videos
- Projectes de recerca ICRA: 3 videos
- L'ICRA als mitjans de comunicació: 4 videos
- Ens agrada: 4 videos
- Dia Mundial de l'Aigua 2016: 3 videos
- Conferències ICRA: 2 video
- Globaqua: 1 video

## PRESS RELEASES

21/02/2018

### L'ICRA rep més d'1,6 M€ de fons per a 8 nous projectes de recerca

<https://press.clipmedia.cat/notas/icra-rep-mes-de-16-milions-euros-de-fons-per-a-8-nous-projectes-de-recerca/>

### El ICRA recibe más de 1,6 M€ de fondos para 8 nuevos proyectos de investigación

<https://press.clipmedia.cat/notas/el-icra-recibe-mas-de-16-millones-euros-de-fonds-para-8-nuevos-proyectos-de-investigacion/>



10/04/2018

### La presència de productes farmacèutics a la xarxa fluvial augmentarà fins en un 65% el 2050

<https://press.clipmedia.cat/notas/la-presencia-de-productes-farmacaceutics-a-la-xarxa-fluvial-aumentara-fins-en-un-65-el-2050/>

### La presencia de productos farmacéuticos en la red fluvial aumentará hasta un 65% en 2050

<https://press.clipmedia.cat/notas/la-presencia-de-productos-farmacaceuticos-en-la-red-fluvial-aumentara-hasta-un-65-en-2050/>



26/07/2018

### FACSA, ICRA y ABM desarrollan una nueva técnica que detecta infiltraciones en los colectores del alcantarillado

<https://press.clipmedia.cat/notas/facsa-icra-y-abm-desarrollan-una-nueva-tecnica-que-detecta-infiltraciones-en-los-colectores-del-alcantarillado/>

### FACSA, ICRA i ABM desenvolupen una nova tècnica que detecta infiltracions en els col·lectors del clavegueram

<https://press.clipmedia.cat/notas/facsa-icra-i-abm-desenvolupen-una-nova-tecnica-que-detecta-infiltracions-en-els-collectors-del-clavegueram/>



05/09/2018

### Espanya és un dels països amb més exposició a disruptors endocrins en peix i marisc

<https://press.clipmedia.cat/notas/espanya-es-un-dels-paisos-amb-mes-exposicio-a-disruptors-endocrins-en-peix-i-marisc/>

### España es uno de los países con mayor exposición a disruptores endocrinos en pescados y mariscos

<https://press.clipmedia.cat/notas/espana-es-uno-de-los-paises-con-mayor-exposicion-a-disruptores-endocrinos-en-pescados-y-mariscos/>



12/12/2018

### Científics i experts presenten a Barcelona les claus sobre la gestió de l'aigua en situacions extremes

<https://press.clipmedia.cat/notas/conferencia-final-globaqua-cientifics-i-experts-presenten-a-barcelona-les-claus-sobre-la-gestio-de-l-aigua-en-situacions-extremes/>

### Científicos y expertos presentan en Barcelona las claves sobre la gestión del agua en situaciones extremas

<https://press.clipmedia.cat/notas/conferencia-final-globaqua-cientificos-y-expertos-presentan-en-barcelona-las-claves-sobre-la-gestion-del-agua-en-situaciones-extremas/>



[www.icra.cat](http://www.icra.cat)

Catalan Institute for Water Research

H<sub>2</sub>O Building  
Scientific and Technological Park  
of the University of Girona

Emili Grahit, 101  
17003 Girona (Spain)  
(+34) 972 18 33 80  
info@icra.cat







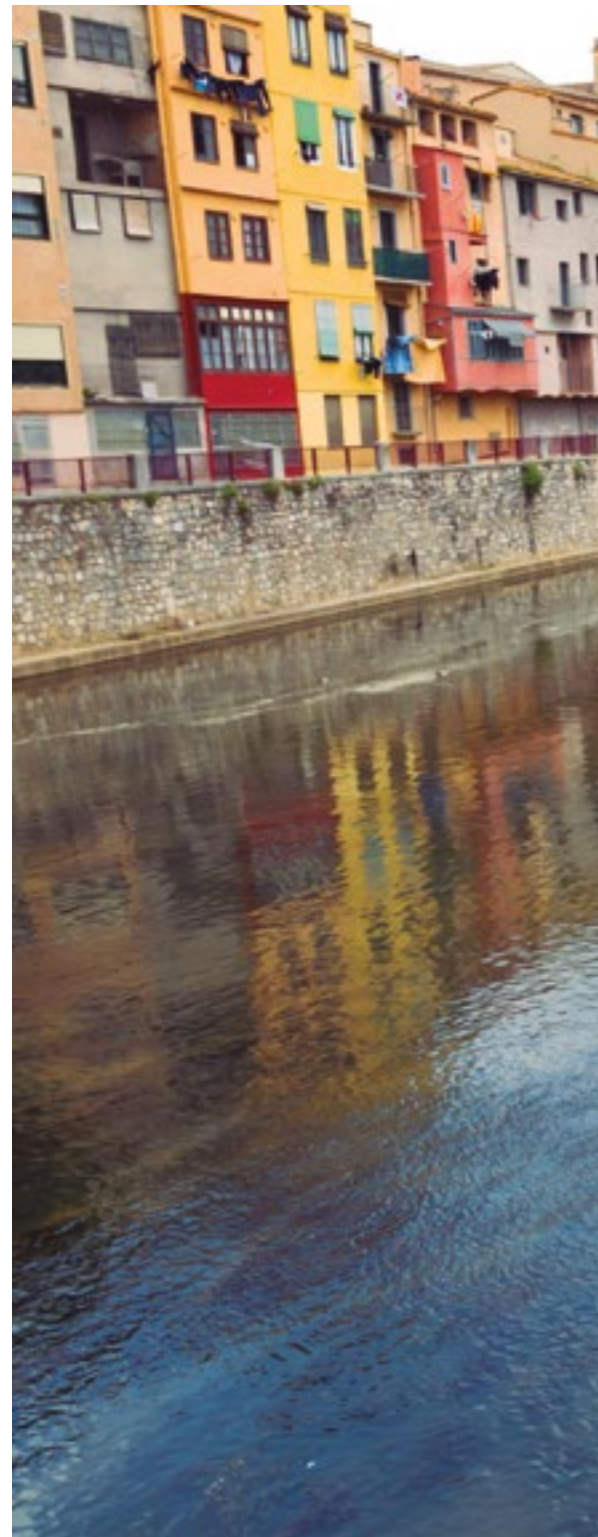
Institut Català  
de Recerca de l'Aigua  
Instituto Catalán  
de Investigación del Agua  
Catalan Institute  
for Water Research

[www.icra.cat](http://www.icra.cat)

Catalan Institute for Water Research

H<sub>2</sub>O Building  
Scientific and Technological Park  
of the University of Girona

Emili Grahit, 101  
17003 Girona (Spain)  
(+34) 972 18 33 80  
info@icra.cat



Trustees



Supported by

