



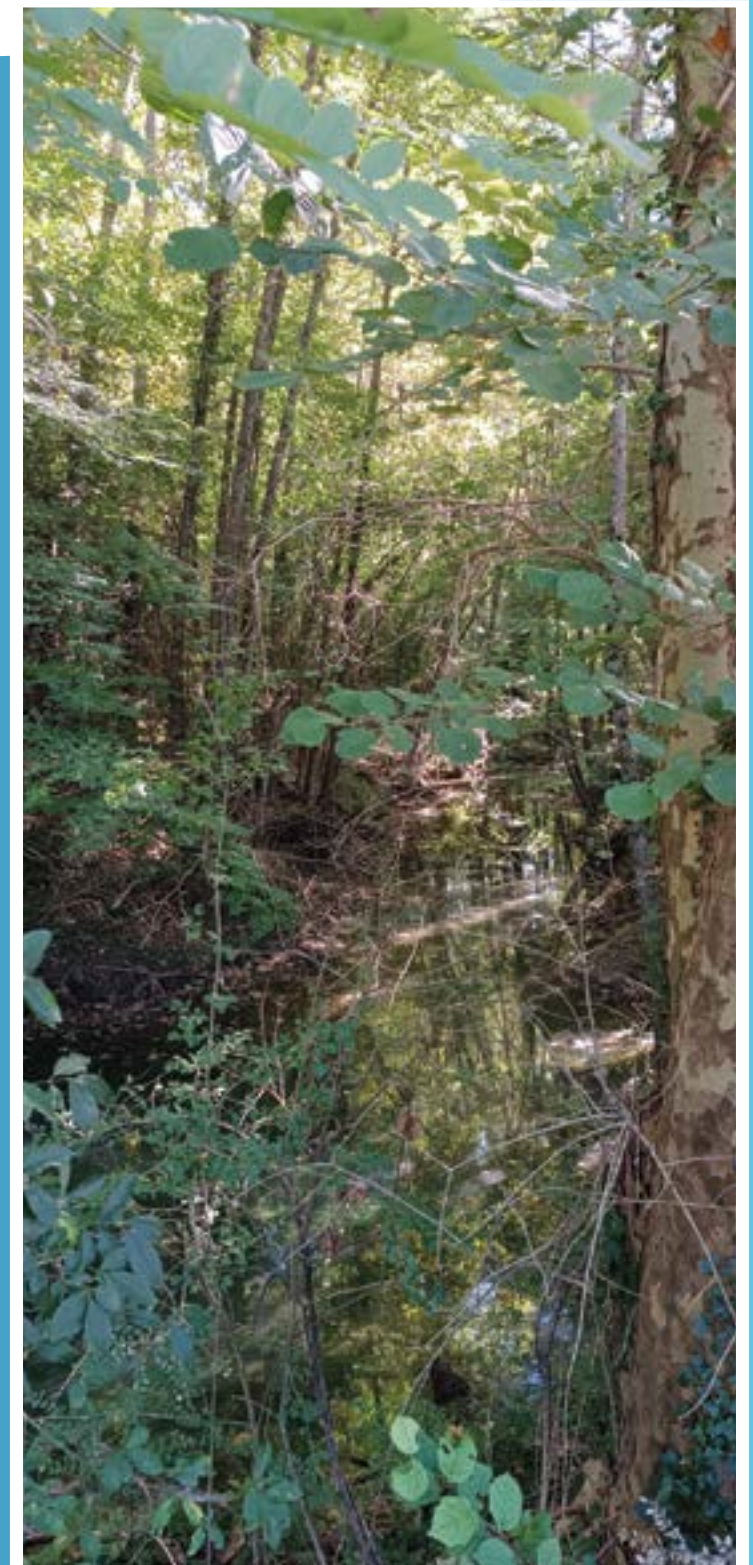
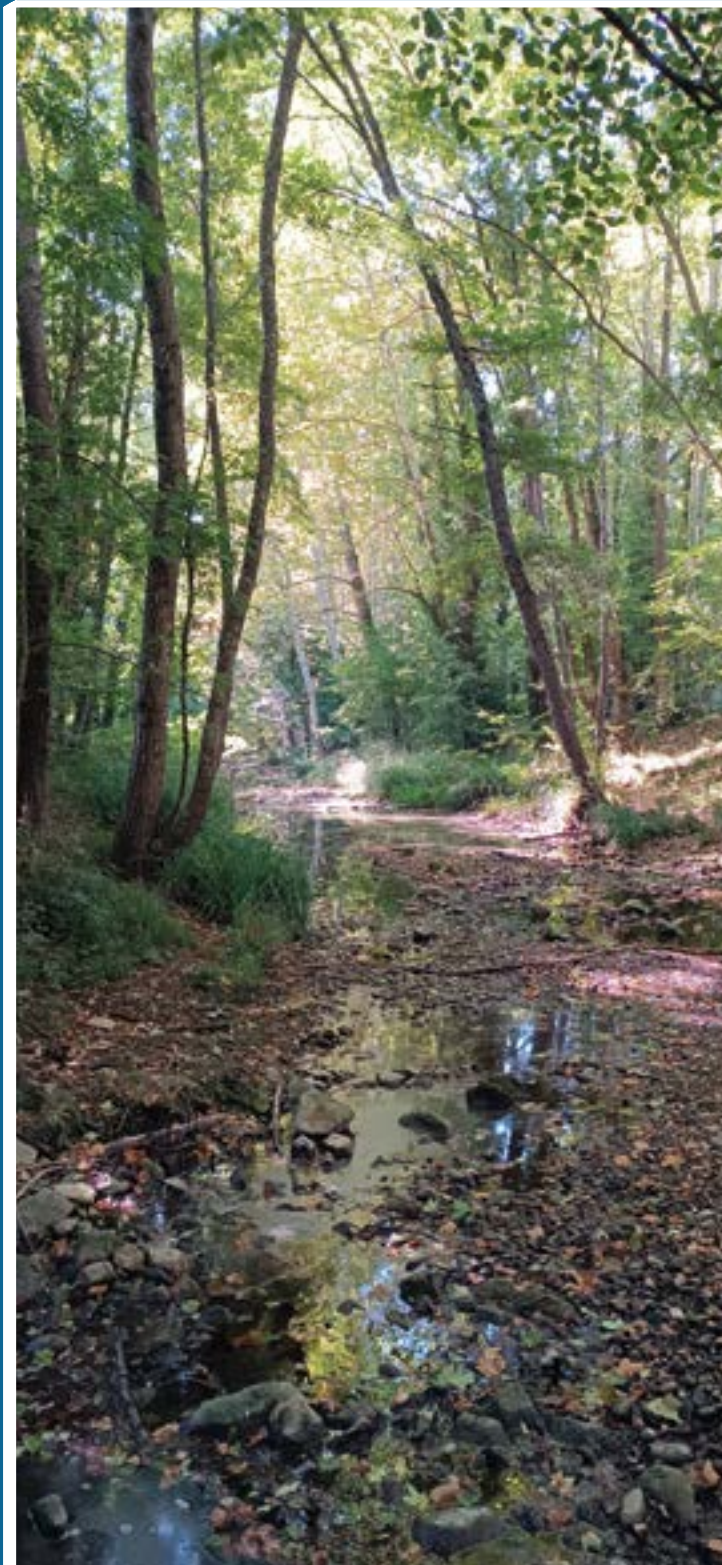
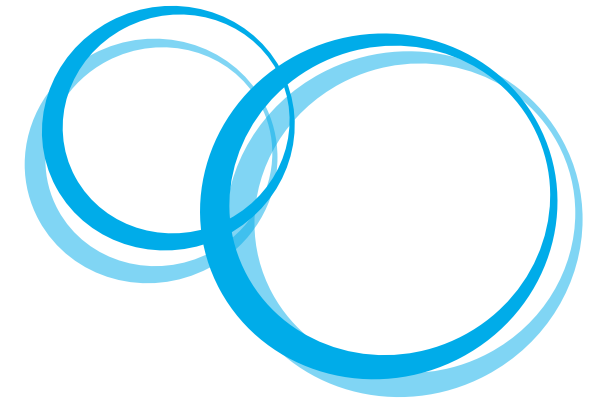
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de Recerca de l'Aigua

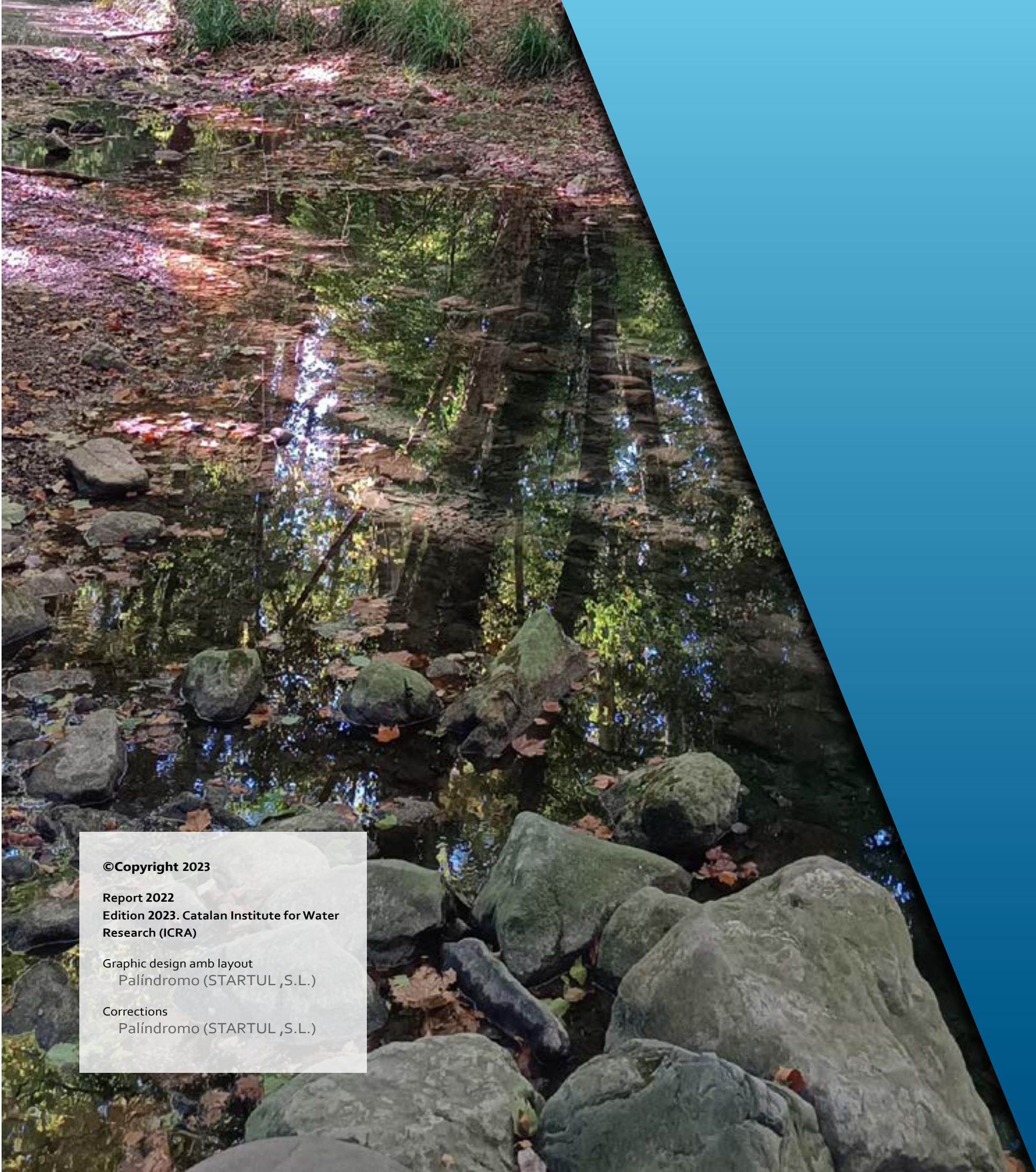
www.icra.cat



ANNUAL REPORT 2022

ICRA research institute attached to the university of Girona





Contents

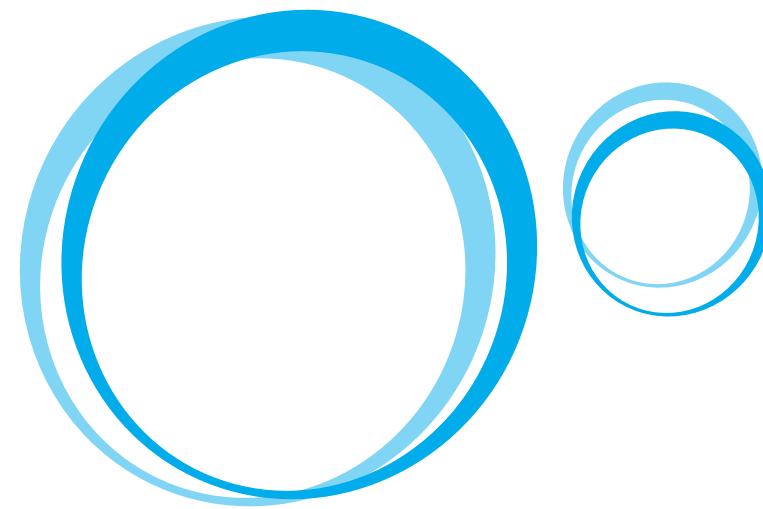
00	<u>PRESENTATION</u>	7
01	<u>DESCRIPTION</u>	9
02	<u>MISSION AND VISION</u>	11
03	<u>ORGANISATION</u>	13
	BOARD OF TRUSTEES	14
	SCIENTIFIC ADVISORY COMMITTEE	16
	PUBLIC ADMINISTRATION AND BUSINESS MIXED COMMITTEE	18
	DEPARTMENTS & STAFF	19
	R&D&I SUPPORT SERVICES	20
	ADMINISTRATION	20
	R&D&I OFFICE	21
	TECHNICAL AND SCIENTIFIC PLATFORMS	22
04	<u>RESEARCH AREAS</u>	29
	RESOURCES AND ECOSYSTEMS	32
	WATER QUALITY & SAFETY	40
	TECHNOLOGIES AND ASSESSMENT	52
	PUBLICATIONS AND CONGRESSES	63
05	<u>PROJECTS</u>	77
06	<u>CONTRACTS</u>	89
07	<u>AGREEMENTS</u>	93
08	<u>OTHER DISSEMINATION ACTIVITIES</u>	97
09	<u>AWARDS</u>	131
10	<u>FINANCING</u>	133
11	<u>ICRA IN THE NEWS & PRESS</u>	135
12		

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Research (ICRA)

Graphic design amb layout
Palíndromo (STARTUL ,S.L.)

Corrections
Palíndromo (STARTUL ,S.L.)



00

Presentation

Following on from previous years, the Catalan Institute for Water Research-ICRA is delighted to present this year's **2022 Activity Report**.

Among the many developments in 2022, I would like to highlight the fact that **ICRA's new 2021-2030 Strategic Plan** was approved by our Board of Trustees. The new SP adapts to the changing reality faced by ICRA, given the current and future scenarios arising from climate change, water scarcity and quality issues, and the new demands from industry, government and society in general.

Within the framework of the European HRS4R award (The Human Resources Strategy for Researchers), ICRA drafted its **Green Charter** and **Sustainable Development Goals (SDGs)** document to raise awareness and motivate the ICRA community to work towards the selected Sustainable Development Goals (SDGs) through its work in three research areas: Resources and Ecosystems, Water Quality and Safety, Technologies and Evaluation.

Also of note is ICRA's collaboration with the University of Girona to launch "**Ecomemb S.L.**", a **spin-off company** related to the European patent "Rend-cap device. Self-assembling membrane housing for low-pressure water filtering applications", for the recycling of reverse osmosis membranes.

In 2022, we administered a total of **3 million euros** in projects. In terms of scientific output, we produced **153 publications, of which 141 were scientific articles** published in high-impact journals, and we also had 36 **doctoral theses** in progress.

With regard to personnel, we expanded our structural workforce by offering a **permanent research scientist position** in the Water Quality and Safety Area to a Ramon y Cajal researcher and adding **three new research support positions (one research technician and two specialist technicians)**. We also secured **nine research positions** under the **INVESTIGO Programme**. In 2022, ICRA employed **127 people, of whom 95 were researchers, nine worked for the Scientific and Technical Services, and 23 were technical support and administration and management staff**.

These achievements were made possible by the commitment of the entire ICRA team, including our researchers, technical and support staff and administrative staff, whose hard work and dedication maintain ICRA's high standards of professionalism year after year.

I therefore invite you to read this latest edition of the Activity Report and hope you find it interesting. Yours sincerely,

Damià Barceló
DIRECTOR

01

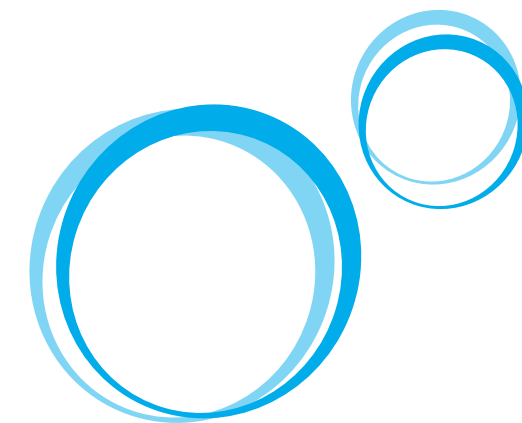
Description

The Government of Catalonia established the Catalan Institute for Water Research (ICRA) within the framework of its **Catalan Research Centres Programme (CERCA)** on 26 October 2006. **ICRA forms part of the CERCA programme.**

ICRA is supported by its trustees: **the Catalan Ministry of Research and Universities, the Catalan Water Agency (ACA) and the University of Girona (UdG).**

ICRA is a **multidisciplinary water research centre** covering the complete water cycle. Research at the Institute deals with a range of topics, including the availability of **water resources**, **the importance of biodiversity**, assessing **water quality** (chemical, microbiological, ecological, etc.) and the development and evaluation of **treatment technologies**, as well as the **transfer of this knowledge** to the wider society, industry and the business network.

ICRA's headquarters are located at the **H₂O building at the University of Girona's** Science and Technology Park, inaugurated on 7 October 2009. The H₂O building is equipped with cutting-edge facilities and technologies that are used to carry out national and international research projects. **The Institute's scientific equipment was co-financed by the Ministry of Economic Affairs and Digital Transformation (MINECO) and the European Regional Development Fund (ERDF), within the framework of the ERDF Operational Programme for Catalonia 2007-2013.** Furthermore, between 2010 and 2011, and within the framework of the **2010 Spanish budget (MICINN, now MINECO)**, ICRA was awarded a nominal subsidy to purchase the equipment required to commission artificial river facilities.



02

Mission and vision

MISSION

ICRA's mission is to attract the scientific talent and financial resources necessary to maintain a centre of excellence in water. The Institute generates essential knowledge on hydrological processes, aquatic ecosystems (including human and ecological health), and chemical and microbial contaminants, particularly under conditions of water scarcity and environmental extremes (such as droughts and floods). ICRA enforces the development of appropriate technologies for water treatment, improvement, and reuse. ICRA conducts fundamental research with an interdisciplinary approach and translates this knowledge to administration, industry, scientists, decision-makers, and society in general.

VISION

ICRA's vision is to continue to be a centre of excellence in water and to respond efficiently and competitively to the problems and challenges related to the cycle of water in general and to the state of ecosystems, water resources, impacts of new products, new treatment technologies and sustainable use of resources within (though not exclusively) the Mediterranean climate.



03

Organisation

BOARD OF TRUSTEES

SCIENTIFIC ADVISORY COMMITTEE

PUBLIC ADMINISTRATION AND BUSINESS MIXED COMMITTEE

DEPARTMENTS & STAFF

R&D&I SUPPORT SERVICES

ADMINISTRATION

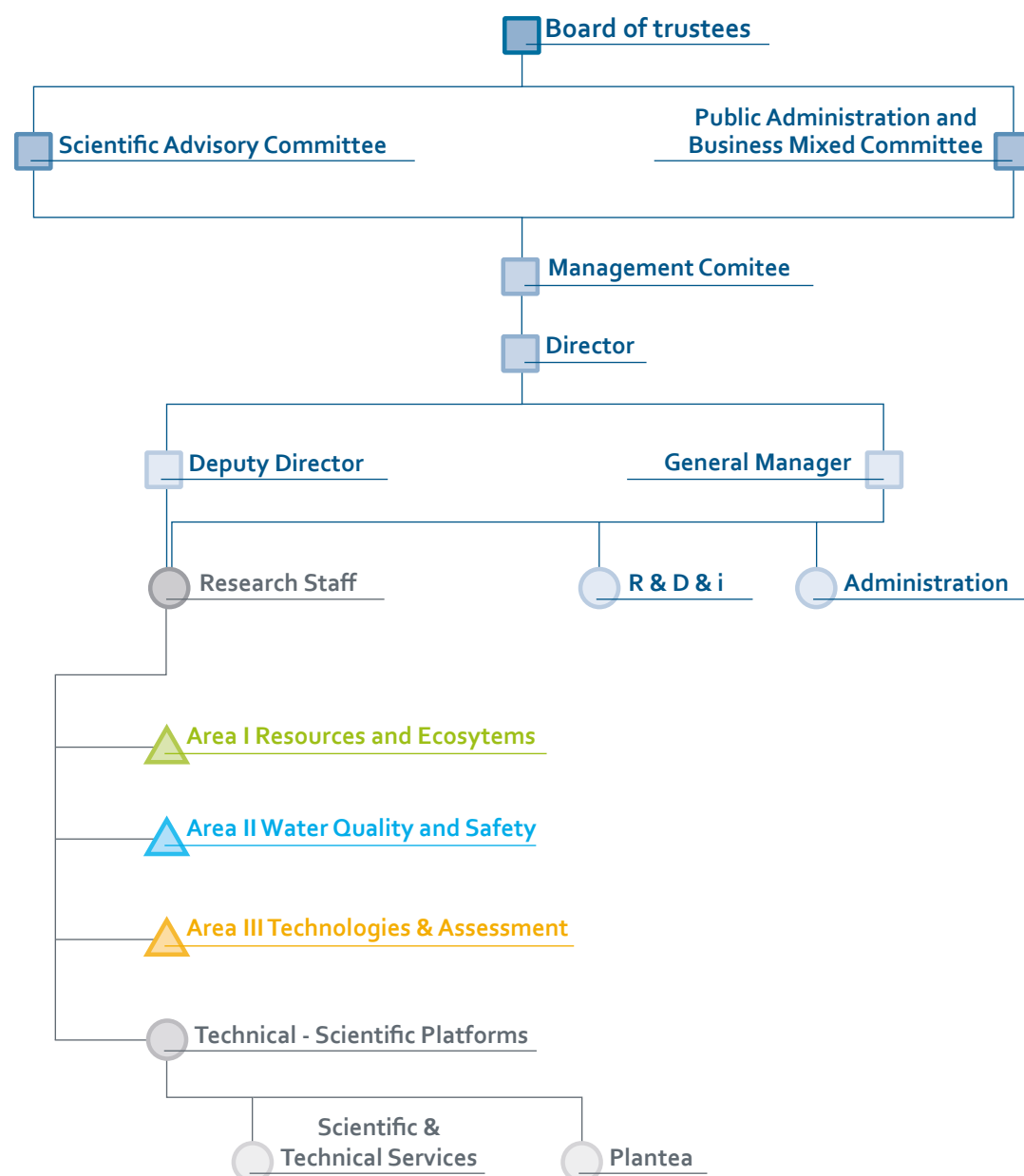
R&D&I OFFICE

TECHNICAL AND SCIENTIFIC PLATFORMS

BOARD OF TRUSTEES

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

In 2021, the ICRA Board of Trustees met once in an ordinary session on 02/06/2021.



MEMBERS

PRESIDENT

Gemma Geis (until october 2022)

Minister of Research and Universities
Regional Government of Catalonia

Joaquim Nadal i Farreras (since october 2022)

Minister for Research and Universities
Regional Government of Catalonia

Samuel Reyes (until November 2022)

Director of the Catalan Water Agency
Catalan Water Agency
Ministry of Climate Action, Food and Rural Agenda
Regional Government of Catalonia

Josep M. Sangrà (since Novembre 2022)

Catalan Water Agency
Ministry of Climate Action, Food and Rural Agenda
Regional Government of Catalonia

VICE- PRESIDENT

Joaquim Salvi

Rector
University of Girona

MEMBERS – VOCALS

Joan Gómez Pallarès

General Director of Research
Ministry of Research and Universities
Regional Government of Catalonia

Anna Albar Parxés

Managing Director
Science and Technology Park
University of Girona

Josep Calbó Angrill (until May 2022)

Vice-rector of Strategic Projects
University of Girona

Maria Pla de Solà-Morales (since May 2022)

Vice-rector of research and Knowledge Transfer
University of Girona

TRUSTEE SECRETARY

Lluís Rovira

Director of CERCA (Catalan Research Centres)
Ministry of Research and Universities
Regional Government of Catalonia

NON-TRUSTEE DEPUTY SECRETARY

Josep M. Alcoberro

Legal advisor of CERCA (Catalan Research Centres)
Ministry of Research and Universities
Regional Government of Catalonia

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. On 22 April, a meeting was held to present the entity's new Strategic Plan for the years 2021-2030, as well as the proposal for reformulating the entity's lines of research, which was supported by a SWOT analysis.

Members of the Scientific Committee



Bernd Bilitewski

Chair of the Scientific Advisory Committee
Emeritus Professor of the Institute for Waste and Pollutant Management, Dresden University of Technology (DE).



Jeanne Garric

Director of the Ecotoxicology Laboratory, Aquatic Ecosystems Biology Unit, Department of Water Quality and Pollution Prevention, INREA (National Institute of Agricultural Research) (FR).



Clifford Dahm

Emeritus Professor of the Department of Biology, University of New Mexico, Albuquerque (USA).



Jörg Overmann

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



Amadeo Rodríguez Fernández-Alba

Head of the European Reference Laboratory for Pesticides and Faculty member of the Department of Hydrogeology and Analytic Chemistry, University of Almería, Almería (ES).



Maria Reis

Tenured lecturer in Environmental Biotechnology, Department of Chemistry, Sciences and Technology Faculty, NOVA University Lisbon (UNL) (PT).



Peter Vanrolleghem

Holder of the Canada Research Chair on Water Quality Modelling (modelEAU) and Professor of the Department of Civil Engineering and Water Engineering, Université Laval, Quebec (CA).



Fang Wang

Professor, Institute of Soil Science, Chinese Academy of Sciences (CN).



Paola Verlicchi

Professor in Environmental and Sanitary Engineering, Engineering Faculty, Department of Engineering, University of Ferrara (IT).



Yolanda Picó García

Tenured lecturer, University of Valencia, Desertification Research Centre (CIDE) (ES).



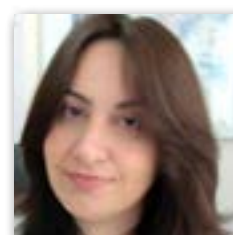
Stan Gregory

Emeritus Professor, Department of Fisheries and Wildlife, Oregon State University (USA)



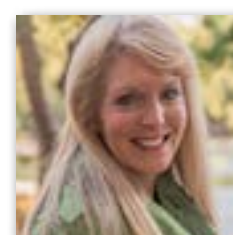
Krishna Pagilla

Ralph E. & Rose A. Hooper Engineering Professor and Chairman, Civil and Environmental Engineering Department and Director of the Nevada Water Innovation Institute, University of Nevada.



Despo Fatta-Kassinou

Associate Professor, Director of Nireas-IWRC, Department of Civil and Environmental Engineering and Nireas International Water Research Center (Nireas-IWRC), University of Cyprus (CY).



Susan D. Richardson

Professor of Chemistry Department of Chemistry & Biochemistry, University of South Carolina (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 the director and may issue recommendations for guidance.

The ICRA Board of Trustees met in June 2021 and agreed to renew all the members of the Public Administration and Business Mixed Committee, incorporate representatives from the sector's most representative companies and associations and appoint a new chairman.

On 19 July 2021, the new members of the Committee met in an online meeting during which ICRA's management and researchers gave a general presentation about the Institute.

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

- Assisting in detecting industry needs and suggesting specific business proposals.
- Identifying attractive technology development opportunities.
- Promoting participation in joint research projects and facilitating the Foundation's access to public and private resources.
- Assisting in the creation of spin-offs.
- Participating in activities related to the Foundation's objectives.

MEMBERS



Jordi Agustí

Chair of the Business Committee
Manager (Consorci d'Aigües Costa Brava Girona)



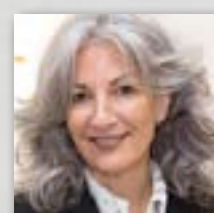
Amadeu Ros

Chair (Associació Catalana de Comunitats de Regants - ACATCOR)



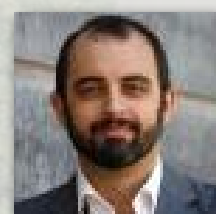
Carlos Montero

General Director (CETAQUA - Water Technology Centre, Private Foundation)



Lara Duro

CEO (AMPHOS 21 Group, SL)



Xavier Amores

Director (Catalan Water Partnership - CWP)



Joan Sanz

Technical Direction (VEOLIA - Water Technologies)



Ana Jiménez

Head of Innovation Management and Technology Transfer- R&D department (ACCIONA- AGUA)



Begoña Martínez

Territory Manager (Besòs-Tordera Consortium)

DEPARTMENTS & STAFF



**DIRECTOR
Damia Barceló**

Research Professor of the Institute of Environmental Assessment and Water Studies (IDAEA), of the Spanish National Research Council (CSIC).



**DEPUTY DIRECTOR
Sergi Sabater**

Professor in Ecology at the University of Girona.



**GENERAL MANAGER
Iván Sánchez**

General Manager



**EXECUTIVE SECRETARY
Olga Corral**

Executive Secretary, Director's Office

In 2022,
127 people contributed to ICRA's R&D&I activities
95 researchers
28 Management/Administration/STS personnel
4 R&D&I 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 (STS)**
 - > **PLANTEA**

ADMINISTRATION

In 2021, 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** managed three types of contracts: services, supplies and construction, with the objective of providing ICRA's three research areas and the STS 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 Economic Affairs and Digital

Transformation), directly and through the Third Additional Provision (DA3a) of the Catalan Statute of Autonomy.

General Manager - **Iván Sánchez**
 Executive Secretary, Director's Office - **Olga Corral**
 Human Resources Head - **David López**
 Ecofin Head - **Susana Roca**
 Accounting and Support to Research - **Janina Manrique**
 Administration Technician - **Laura Sancho**
 Administration Officer - **Yamila Zambrano**
 IT Head - **Rubén Díaz**
 Reception - **Pere Royo, Sandra Monleón**
 Reception (non-active ICRA) - **Alba Martín**
 Administration Visiting Student
Esbet Prades, Marc - IES MONTILIVI (GIRONA)
Vararean, Codrut Andrei - FEDAC SANT NARCIS



R&D&I OFFICE



Jaume Alemany
R&D&I Office Manager



Laura Bertolini
European and International Project Officer



Rina Weltner
Project Manager

Objectives and activities of the R&D&I Office

The R&D&I Office aims to increase ICRA's capacity to obtain and execute research projects and to gain international prestige by obtaining external funding and establishing international alliances. The Office helps researchers participate in basic and applied research projects at both national and international levels and enhance their relationships with the productive and industrial sectors to implement their research results.

The Office helps ICRA's researchers define and implement a strategy for participating in public calls for research funding at a local, national and international level. From the Office, we offer our researchers help with finding calls and preparing and submitting proposals, and we also offer them advice on financial and legal issues relating to calls. Finally, the Office also handles the administrative and financial management of the projects granted and the knowledge and technology transfer (KTT) contracts with local, national or international companies.

In terms of national funding, a total of 14 proposals were submitted to Spanish and Catalan funding agencies in 2022. Nine were awarded for a total amount of €1.45 M. We must also highlight that ICRA was awarded 9 fellowships under the Call Investigo funded by the Catalan Government's Secretariat for Universities and Research, with a total value of €0.6 M.

At this moment, 3 proposals from 2022 calls are still pending resolution for a total amount of €0.68 M.

In 2022, the National Projects Unit managed a total of twenty-three research projects, nineteen of them funded by the Spanish National Funding Agency (AEI), two funded by the Catalan Water Agency, one by the Fundació TV3 Marató, and one funded by the Secretariat for Universities and Research of the Catalan Government.

The unit also managed 34 Fellowship Grants, twelve

funded by AEI-MINECO and twenty-two funded by the Catalan Government's Secretariat for Universities and Research.

As for the Knowledge and Technology Transfer Unit (KTT), eight collaborative contracts were signed with private companies and public entities in 2022, worth €255,000. The average budget per project (€32 M) in 2022 was slightly lower than in 2021 (€41 M).

During 2022, the KTT unit also managed 16 collaborative contracts and the bureaucracy for the four patents, one granted and three under evaluation.

In regard to IPR management, this year, within the framework of the above-mentioned Investigo fellowships, Jesús Luque joined the KTT unit to provide support for scouting and valuing assets emerging from research results and protecting their possible future commercialisation.

Finally, ICRA, in collaboration with University of Girona, has created the spin-off company "Ecomemb S.L." to economically exploit the European Patent "Rend-cap device. Self-assembling membrane housing for low-pressure water filtering application" for the recycling of Inverse Osmosis membranes. Within this framework, the patent has been licensed to the Ecomemb spin-off.

In the last 5 years alone (2017-2022), almost 200 proposals were submitted to European and international institutions with ICRA as coordinator or beneficiary, 33 of which were successful, representing an overall success rate of 17% and total funding worth more than €10 M, while 25 are still pending resolution (12%).

Some of the most recently funded projects include 8 H2020 and Horizon Europe collaborative projects in which ICRA participates as a beneficiary (EMERGE, SCOREwater, HYDROUSA, DRYVER, iWAYS,

MULTISOURCE, EdiCitNet and MERLIN), one Horizon Europe project -intoDBP- in which ICRA acts as the coordinator of a consortium of 12 partners for a total of €4 M (0.8 M for ICRA), one Horizon Europe Twinning project -SMARTWATERTWING- with Serbia, 2 Horizon Europe Marie Skłodowska-Curie Actions Innovative Training Networks, in which ICRA acts as coordinator (Nowelties and inventWater) and 2 Horizon Europe Marie Skłodowska-Curie Actions Postdoctoral Fellowships (FOCUS4PFAS and DEAR-WASTE).

In these last 5 years, ICRA has also been successful

in obtaining funding from the Spanish Ministry, participating in Joint Programming Initiatives and ERANET initiatives such as PRIMA (Partnership for R&I in the Mediterranean Area). At the moment, we are running 3 of these projects: PhageLand where ICRA participates as coordinator (Joint Programming Initiative on Antimicrobial Resistance, JPIAMR), ARENA (AquaticPollutants Joint Transnational Call 2020) and SAFE (Partnership for R&I in the Mediterranean Area, PRIMA), for a total of €0.6 M.

TECHNICAL AND SCIENTIFIC PLATFORMS

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

THE PLATFORMS ARE THE FOLLOWING:

SCIENTIFIC AND TECHNICAL SERVICES (STS)

In 2022, a **pyrolyser coupled to a gas chromatograph with a single quadrupole mass spectrometer** was installed, thus initiating the project to develop a methodology for determining microplastics. This preliminary work was supervised by the Mass Spectrometry Unit (UEM) and carried out in collaboration with the student Marta Arxé and her final dissertation for the Master's in Applied Chromatographic Techniques: Evaluation and application of a methodology based on pyrolysis coupled to gas chromatography-mass spectrometry (Pyr-GC/MS) for the analysis of microplastics in environmental samples (agreement FC_TF_2021-22_0062) (period: 28/03/2022 to 23/06/2022).

In addition, following the guidelines to assist and strengthen the research carried out at ICRA, throughout 2022, the UEM has actively contributed to the optimising an analytical procedure based on solid-phase microextraction (SPME) coupled to gas chromatography with triple quadrupole mass spectrometry detection (GC-MS/MS) for the determination of **Di(2-ethylhexyl)phthalate (DEHP)**, a chemical compound with multiple uses that is frequently found in the water from chemical treatments applied in laundries.

Of all the actions channelled through the STS, the deployment of the CERCAGINYS project, an initiative financed by the MICINN, which aims

to provide the scientific community and private enterprise with access to scientific and technical infrastructures, has represented an opportunity to strengthen the institution both from the point of view of its promotion and operation, through the funding received and participation in the different activities programmed. In this context, the STS has contributed to CERCAGINYS through the following actions:

- 1) Contribution as a member of the Technical Secretariat, which, through monthly meetings, has been responsible for monitoring the project's progress.
- 2) Participation in plenary meetings of all project members and working group sessions.
- 3) Updating and maintenance of the content of the CERCAGINYS website (<https://ginys.cerca.cat/>), a portal for accessing the different scientific platforms classified according to categories, accreditations, CERCA centre and/or field.
- 4) Initiating the process of implementing a quality system based on the requirements of the ISO 9001:2015 standard in the Chemical Analysis Unit (UAQ) (GINYS-ICRA-001). This project has been divided into two phases: the first phase, between October and December 2022, established the basis of the system, and the second phase, to be deployed in 2023, is expected to complete the implementation.
- 5) Participation in training activities.
- 6) Participation in promotional activities. The dissemination of the project by ICRA consisted of the following activities:
 - a. Dissemination through the ICRA website
 - b. Dissemination through social networks
 - c. Dissemination through internal channels

- d. Dissemination via email
- e. Dissemination through the preparation of specific audiovisual material
- f. Appearance in poster format communications at congresses:
 - o 18th ANNUAL WORKSHOP ON EMERGING HIGH-RESOLUTION MASS SPECTROMETRY (HRMS) AND LC-MS/MS APPLICATIONS IN ENVIRONMENTAL ANALYSIS AND FOOD SAFETY (Barcelona, 10 – 11 October 2022):
 - 1) Analysis of a wide range of organic contaminants in environmental samples using cross-platform services
 - 2) Analysis of microplastics in the environment: Identification and quantification of trace levels of common types of plastic polymers using pyrolysis-GC/MS
 - o PLASTIC'2022: PLASTIC POLLUTION: the Textile Sector, an example of moving towards a sustainable economy (Barcelona, 21 - 22 November 2022):
 - 3) A reliable and rapid approach for the analysis of the plasticizer di(2-ethylhexyl) phthalate (DEHP) in laundry wastewater using online HS-SPME-GC-MS/MS

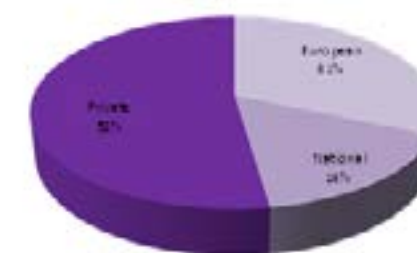
A large part of the funding received from the project has been used to undertake maintenance and/or repairs of equipment, which the STS has included in the CERCAGINYS platform via service provision. Of the 4 infrastructures that ICRA collaborates with, the Chemical Analysis Unit (UAQ) has been allocated the most resources to ensure its technical competence and thus facilitate the process of implementing the quality system.

Throughout 2022, ICRA has been working on revamping its **website** to make it more accessible and up-to-date. The STS is in the process of updating its section both visually and in terms of content, with the Units being provided with specific emblems to make them more distinctive.

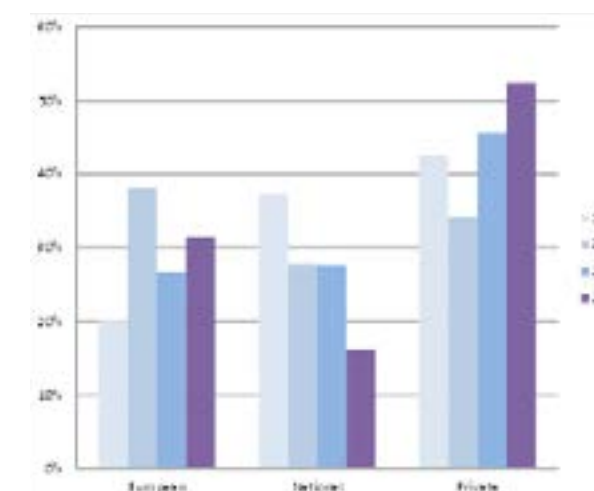
In the context of updating the website and with the aim of providing its own quality content, steps have been taken to renew the image of the STS. A **video** has been produced to boost the external promotion of the STS, focusing on the laboratories' wide range of analytical possibilities and highlighting the importance of the human factor. This video has already been posted on ICRA's social networks (Linkedin, Twitter, Youtube, etc.) and will be a key element in the main STS section of the new website. In addition, new professional photographs have been taken of the facilities, relevant equipment, and personnel.

TECHNOLOGY TRANSFER

The overall economic contribution derived from the activity of the STS in 2022, in terms of executing analytical requests, is distributed between three sources: national projects, European projects and external collaborations (private). As can be seen in the figure below, there is an almost even balance between the time the STS dedicates to internal projects and the time it spends on private requests (52%), which is evidence of the trend towards consolidating the STS as a service platform at an external level.



The distribution of resources from the STS's analytical work over the last four years reflects an increase in income from European and private projects, confirming that external customers are becoming increasingly loyal to the STS project and have confidence in it.



HUMAN RESOURCES

One of the priorities in 2022 was to increase the technical support personnel that shape the STS. For this reason, we hired Maria Samaniego, a specialised technician with a transversal profile, for a period of 6 months (from March to September) to support the Chemical Analysis Unit (UAQ), Mass Spectrometry Unit (UEM), Biological and Molecular Techniques Unit (UTBM) and the Microscopy Unit (UM).

Subsequently, Maria Samaniego was also selected to cover the paternity leave of the head of UTBM.

In addition, we applied for two public subsidy awards to finance recruitment. The Investigo Programme call for applications from the Catalan Government and financed by the European Union-Next Generation EU allowed the incorporation of Marta López in the Mass Spectrometry Unit (MSU) as a specialised technician providing support for all stages of the analytical procedure to determine organic compounds in aqueous matrices, and that of Adrià Robles as a specialised technician supporting the Chemical Analysis Unit (UAQ), the Mass Spectrometry Unit (UEM), the Biological and Molecular Techniques Unit (UTBM) and the Microscopy Unit (UM). In addition, we applied to the call for applications for grants to fund the recruitment of Technical Support Staff of the Spanish State Research Agency's (BOE no. 299 of 2021, 50609). The grant was awarded to Andrea Peris, who joined as Technical Support Staff in January 2023.

ICRA Head of STS:

Insa Aguilar, Sara
(Chemical Analysis Unit)

Sanchez Melsio, Alex
(Biological and Molecular Techniques Unit)

Alvarez Muñoz, Diana
(Mass Spectrometry Unit)



ICRA STS Technicians:

Samaniego Recasens, Maria
Latorre Garcia, Irene
Lopez Martinez, Marta Veronica
Montojo Jordan, Olga
Robles Briones, Adria
Seron Mallol, Natalia
Zambrano Sabando, Carolina
(Non active ICRA)

Visiting Students:

Arxe Danes, Marta –
University of Girona
(Scientific and Technical Services)
Gascon Trullols, David –
University of Girona
(Scientific and Technical Services)

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). This 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 research the application of advanced treatments to both wastewater and treated water or water that can be made potable and carry out projects for monitoring, eliminating, and evaluating the effects of contaminants in water, as well as studies that require large-scale equipment.

The facility 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 (Spanish Ministry of Economic Affairs and Digital Transformation) directly and through the Third Additional Provision (DA3a) of the Catalan Statute of Autonomy.

SCIENTIFIC-TECHNICAL PLATFORMS

The PLANTEA test platform currently provides ICRA with benchmark facilities for fulfilling three different objectives:

- **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 AND HYDROPONICS PILOT)

In 2022, several pilot plants designed to mimic wastewater and water treatment systems were operating on the PLANTEA platform.

Within the context of the ANTARES project, funded by the Agencia Estatal de Investigación (Spanish State Research Agency), an anaerobic membrane bioreactor (AnMBR) has remained in operation. The reactor focuses on the anaerobic treatment of municipal wastewater, with the aim of enhancing the biodegradation of certain micropollutants. Different organic loading rates and graphene oxide dosing strategies have been tested to unravel the effect of this conductive material and the anaerobic biomass. Results indicate an improvement in the degradation of certain pollutants. This reactor is starting the last phase of its operation, with the project finalising in June 2023.

Within another research line, an automated filtration unit for testing ceramic micro- and ultrafiltration that was set up in 2021 continued to operate in 2022 as part of the NOWELTIES project. This unit can be operated with in-line ozonation to research catalytic ozonation and membrane filtration. Furthermore, a membrane distillation lab-scale pilot has been acquired for the iWAYS project. This pilot will be used to design operation protocols for the Basque steel industry's demonstration-scale work on the same technology.

Within the framework of the circular economy pillars,

the feasibility of nature-based re-usage solutions (NBS) is being explored, including the irrigation of crops in cities for more sustainable food production, as part of the ReUseMP3 (2021-2024) and PRIMA-SAFE (2022-2025) projects. To provide more detail, two constructed hydroponic wetlands were operative during 2022. The first, installed at the Hotel Samba (Lloret de Mar), has ornamental and edible plants. At the same time, the hydroponic pilot plant built at ICRA' PLANTEA laboratories was tested for growing edible plants (lettuce, mint) under more stable conditions. It features several lines that can work in parallel, with distinct influent water and sensors to measure temperature, humidity, and light intensity. Its operation has also been evaluated alongside forward osmosis hollow fibre membranes. Different kinds of greywater are being tested (shower, laundry, kitchen greywater), and several other irrigation and/or NBS systems are being designed/evaluated, either at ICRA itself (vertical wall irrigated with greywater) or in other field sites (e.g., urban gardens, municipal gardens, and crops).

The PLANTEA laboratory has unique facilities that allow us to test different wastewater transport and treatment technologies and processes. The fact that it has a direct connection to a sewage pumping station facilitates the use of real wastewater for the experiments conducted in the PLANTEA pilot plants. There are three pilot-scale sewer systems simulating two rising mains from a sewer network

and one gravity section, which are being operated to study the biochemical transformations occurring in these systems. These installations, which are the first of their kind in Europe, allow the researchers to investigate why and how sulphide and methane form during wastewater transport and how their formation can be prevented. Also, PLANTEA offers the possibility of operating 5 reactors to investigate different wastewater treatment processes. All these installations are fully monitored and controlled by different PLC systems connected to a SCADA programme, allowing real-time control of the processes taking place in each of the pilot plants. This is possible thanks to the numerous monitoring systems installed in the PLANTEA facilities, such as dissolved oxygen, pH, redox, nitrate and hydrogen sulphide sensors and online gas analysers for the online monitoring of two potent greenhouse gases, nitrous oxide and methane.

PLANTEA also has the equipment needed to carry out lab-scale ozonation and UV-based oxidation processes (medium-pressure mercury lamps, low-pressure mercury lamps), enabling the study of traditional and novel advanced oxidation processes (UV/persulphate, UV/HOCl). Lastly, at pilot scale, a 254nm UV installation is available for up-scale trials. Also, in 2022, ICRA conducted services for Aquasoil s.r.l. to test their patented MITO3X® technology for coagulation, disinfection and ozonation at pilot scale.

Finally, it is worth mentioning the comprehensive set of commercial and custom-made apparatus for field studies, such as several refrigerated autosamplers, a multi-hood system for the online monitoring of greenhouse gas emissions from bioreactors, online ion-selective electrodes, etc., which allow us to conduct a wide range of experimental fieldwork in all areas of the urban wastewater system.

THE EXPERIMENTAL STREAMS FACILITY (WHICH ALLOWS US TO SIMULATE THE RESPONSE OF FLUVIAL ECOSYSTEMS TO DIFFERENT ENVIRONMENTAL CONDITIONS) AND ARTIFICIAL AQUATIC ECOSYSTEM.

The Experimental Stream Facility (ESF) is a unique platform to study stream processes and organisms, and how they are affected by the presence of pollutants and changes in temperature, light, and water flow. For more than 10 years, the facility has allowed advanced research in the fields of environmental chemistry, ecotoxicology, microbial ecology and stream ecology. It has also attracted the interest of international researchers and encouraged scientific collaborations. During 2022 the installation was halted to solve some technical problems and to adapt it to the use of dechlorinated tap water.

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 recognise that ICRA endorses the policies and practices of the Human Resources Strategy for Researchers (HRS4R), established by the European Commission to implement the principles of the European Charter for Researchers and the Code of Conduct for the recruitment of researchers (Charter & Code).

In December 2018, ICRA underwent an internal review for the HRS4R interim assessment.

ICRA continues to improve its human resources policies to ensure a stimulating and favourable working environment for all staff.



HR EXCELLENCE IN RESEARCH

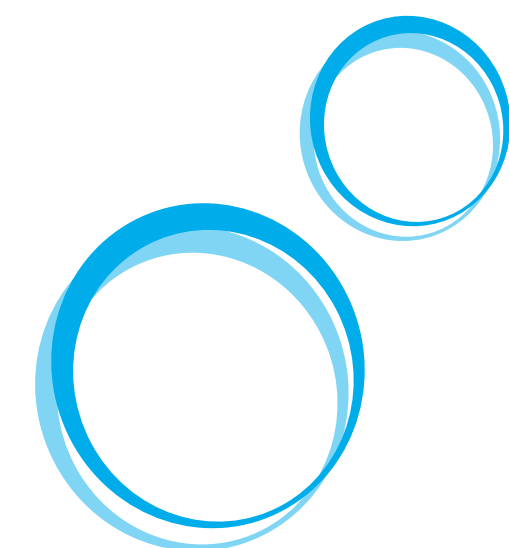
GREEN CHARTER

The EC Marie Skłodowska-Curie Actions (MSCA) Green Charter is a code of good practice for individuals and institutions who receive EC MSCA funding. The participants are expected to adhere to the Green Charter provisions during the implementation of their projects. Some of the measures that individuals and institutions are invited to consider are:

- reduce, reuse, and recycle
- promote green purchasing for project-related materials
- ensure the sustainability of project events
- use low-emission forms of transport
- promote teleconferencing whenever possible
- use sustainable and renewable forms of energy
- develop awareness on environmental sustainability
- share ideas and examples of best practice

In order to comply with the indicated measures, ICRA appointed a MSCA Green Charter Committee in June 2022. The Committee is in charge of monitoring the sustainable implementation of research activities and raising awareness among ICRA employees about the importance of their commitment to address challenges related to climate and the environment.

After some months of work, the Committee created the "ICRA Green Charter", a document that lists all the measures being implemented at ICRA in line with the MSCA Green Charter, which include unique ICRA facilities (e.g., rainwater harvesting for scientific purposes, 3-scale modular green wall, building a heater and boiler with biomass) and best practices (e.g., using digital signatures to reduce paper waste, home working for up to 40% FTE, recycling, promoting teleconferences and Green Public Procurement). The ICRA Green Charter also provides examples of green actions that everybody should follow, both at work and as part of their daily lives. The ICRA Green Charter is published on ICRA SharePoint and the website <https://www.icra.cat/green-charter>. Initiatives to inform ICRA personnel are foreseen for early 2023.



04

Research areas

▶ RESOURCES AND ECOSYSTEMS

LINES

R&E1. HYDROLOGICAL PROCESSES AND WATER RESOURCES

R&E2. AQUATIC BIOGEOCHEMISTRY

R&E3. BIODIVERSITY AND THE FUNCTIONS OF AQUATIC ECOSYSTEMS

R&E4. FRESHWATER-RELATED ECOSYSTEMS SERVICES & NATURE-BASED SOLUTIONS

▶ WATER QUALITY AND SAFETY

LINES

QS1. CHEMICAL CONTAMINANTS AND MICROPLASTICS IN THE AQUATIC ENVIRONMENT

QS2. CHEMICAL CONTAMINANTS IN WATER TREATMENTS

QS3. WATER MICROBIOLOGY

QS4. WATER AND HUMAN HEALTH

▶ TECHNOLOGIES AND ASSESSMENT

LINES

T&A 1. CONVENTIONAL AND ALTERNATIVE WATER SUPPLY

T&A2. WASTEWATER TRANSPORT, TREATMENT AND MANAGEMENT

T&A3. NEXT-GENERATION AND NATURE-BASED TECHNOLOGIES

T&A4. MODELLING, ASSESSMENT AND DECISION-SUPPORT FOR URBAN WATER SUSTAINABILITY AND RESILIENCE

RESOURCES AND ECOSYSTEMS

LINES

- ▷ R&E1. HYDROLOGICAL PROCESSES AND WATER RESOURCES
- ▷ R&E2. AQUATIC BIOGEOCHEMISTRY
- ▷ R&E3. BIODIVERSITY AND THE FUNCTIONS OF AQUATIC ECOSYSTEMS
- ▷ R&E4. FRESHWATER-RELATED ECOSYSTEMS SERVICES & NATURE-BASED SOLUTIONS



1 Technical Support Personnel

Carmen Gutiérrez

25 RESEARCHERS IN THE AREA

Group leader

Vicenç Acuña

2 Research professor (UdG associated)

Sergi Sabater
Josep Mas Pla

1 Research professor (UdL associated)

Ramón Batalla

2 Research Scientists

Vicenç Acuña
Rafael Marcé

5 Postdoc researchers

Anna Freixa Casals
Margot Sepp
Daniel Diaz de Quijano Barbero
Daniel Augusto Mercado Bettin
Xavier García Acosta

5 Predoctoral Researcher

Paula Gabriela Cordoba Ariza,
Daniela Alejandra Henry Pinilla
Oriana Lucia Llanos Paez
Javier Ortiz Rivero
Laia Verdura Estrada

7 Research Technicians

Lorena Cristina Cojoc
Oliu Llorente Moragrega
Noel Carrion Matias
Pau Gimenez Grau
Nils Gutierrez Von Porat
Zineb Moumen
Joan Salo Grau

3 Research Support Technician

Ventura Campillo Grau
Paula Siñeriz Casado
Silvia Zannin Boscarolo

RESOURCES AND ECOSYSTEMS RESEARCH AREA

The activities of ICRA's Resources and Ecosystems Area have been divided between projects due to conclude this year and the start of new projects and activities with companies and public bodies. Postdoctoral researchers (A. Freixa, X. Garcia, D. Mercado, M. Sepp, D. Diaz de Quijano) have

contributed to research projects in the area, as have research technicians (A. Riu, C. Gutiérrez, N. Gutiérrez, J. Saló) and postgraduate students working towards their doctorates (O. Llanos, G.P. Córdoba-Ariza, L. Verdura, D. Henry) or carrying out a research stay.



The lines of research of the Resources and Ecosystems Area are:

R&E1. HYDROLOGICAL PROCESSES AND WATER RESOURCES

In this topic, research has continued on hydrological aspects in different basins, with particular emphasis on the Onyar basin. In 2022, efforts have been devoted to continue the monitoring of the flow rate at the Vernagà hydrometric station (Gavarres massif) to obtain data from this intermittent course, with the aim of evaluating the hypothetical effects of flow reduction on the invertebrate community. The sampling point is equipped with pressure sensors, and the testing of state-of-the-art hydrometric sensors is also planned. The team has maintained the hydrometric instrumentation at three more points in the drainage network of the Onyar River basin and six wells, with sensors to measure the level, temperature, and electrical conductivity of groundwater to analyse

the effects of land uses and climate change on the water resources, ecological quality and water balance of the basin. Twenty-three points along the drainage network of the Onyar River basin have also been sampled to measure flows and provide samples for hydrochemical and nutrient analysis, with the aim of integrating the data and investigating the relationship between the hydrological and hydrochemical changes observed and climate change and the transformation of land uses, as well as with other anthropic pressures.

Research into the quality of the underground resources in different aquifers in Catalonia has also continued. In 2022, the study of the presence of antibiotics and resistance genes in the natural sources of Osona was

concluded, together with colleagues from the Quality Area. This study has shown the as-yet unpublished affinity between the types of antibiotics and the different fractions of organic matter (OM), suggesting possible co-transport processes and/or the evolution of both substances – antibiotics and MO – during transit in the subsoil.

In relation to the presence of emerging pollutants, the TED project "Transport of emerging pollutants in groundwater under conditions of in-situ remediation – EMFASIS" has been initiated. The scope of this project is to evaluate the efficiency of induced attenuation processes aimed at enhancing the denitrification of pharmaceutical compounds in groundwater. This project, coordinated by the University of Barcelona with the participation of the Polytechnic University of Cartagena, will be carried out in the aquifers associated with the Mar Menor, an environmental hotspot.

In relation to groundwater, ICRA organised a virtual workshop to mark World Groundwater Day on 17/03/2022. With the motto "Groundwater: Making the Invisible, Visible" several topics were discussed with guest researchers from different universities, research centres and private companies.

The team has continued to publish research on hydrogeomorphological and hydrogeological processes in surface and groundwater, focusing on quantity and quality in the context of a changing environment due to climatic causes. National and international collaborations have continued, with the aim of helping to consolidate and internationalise the lines of research and the Resources and Ecosystems Area as a whole.

R&E2. AQUATIC BIOGEOCHEMISTRY

Throughout 2022, our research department took significant strides in the field of water quality prediction for lakes and reservoirs. Our involvement in the InventWater project (Inventive forecasting tools for adapting water quality management to a new climate), an MSCA ITN led by ICRA, has invigorated the development of advanced water quality prediction tools in lakes, reservoirs, and river networks. With two of the 15 students in the network based at ICRA and a substantial number conducting research stays at RiE, we are confident that this project will continue to produce innovative tools for both short-term (meteorological output) and long-term (climate projections) water quality prediction.

Our research on the fate of sedimentary carbon in drying lakes as part of the Alter-C (Alteration of carbon sinks and sources in shrinking inland waters) project is progressing well following a successful expedition to the Aral Sea. Despite logistical challenges, the expedition, led by ICRA and involving personnel from three other scientific institutions, achieved significant milestones. The preparation and processing of all the collected samples have taken up a significant portion of our research line's activity in 2022, and we are eagerly anticipating the publication of our first results in 2023.

Our department's coordination of the ISIMIP Lake Sector and GLEON networks has evolved with the commencement of the ISIMIP-3 model run and the appointment of Rafael Marcé as co-chair of the GLEON network. We are incredibly proud of completing our fieldwork for the DryFlux-II collaborative project in 2022, marking a significant milestone in our research pursuits.

Overall, our research department continues to demonstrate our commitment to advancing scientific knowledge in water quality prediction, carbon sinks and inland water sources, and network coordination.





R&E3. BIODIVERSITY AND THE FUNCTIONS OF AQUATIC ECOSYSTEMS

During this reporting period, research has continued into the effects of flow intermittency on stream biota and stream biogeochemistry and the impact of pollutants on the biodiversity, functions, and ecosystem services of freshwater ecosystems.

Most of this research has been carried out as part of the project on “Multiple stressors impacting rivers: biodiversity and ecosystem function responses” (RIVSTRESS; PID2020-115708RB-C22). RIVSTRESS, currently in its second year, aims to investigate the co-occurrence of stressors affecting river ecosystems and their impact on biodiversity, functions, and services. RIVSTRESS seeks to define the effect of some of the most common stressors in Mediterranean watercourses (i.e., hydric stress, increased water temperature, nutrient excess, the presence of pesticides) and investigate their impact. The project is unique in that it attempts to outline the relevance of stressors according to i) their order of occurrence, ii) their intensity, and iii) whether the effects of present stressors are modulated or not by the previous impacts of alternate stressors, causing legacy effects. These goals are approached through field and laboratory approximations.

The relevance of hydrological patterns of intermittency on carbon dynamics has been studied in the Algars River basin, which was modelled using the SWAT+ platform. We are currently looking to combine both the carbon dynamics and the hydrological dynamics in order to define patterns in different hydrological scenarios. This work, when finalised, will allow us to predict variations in the transport of organic matter under different climatological scenarios, including those foreseen by climate change. These are main tasks identified in the PhD thesis of Oriana Llanos. We have also tried to understand how hydrology, land use changes and climate change affect river water chemistry in the Onyar River basin. This is one of the primary tasks identified in Gabriela Córdoba’s PhD thesis. In an initial analysis, we observed a consistent decrease in streamflow at the river’s outflow, predominantly in the last thirty years. Water flow alteration mostly involves a decrease in high and medium-flow rates and an increase in low-flow episodes. Hydric stress results in concentrations of river water ammonia and nitrate being maintained, regardless of efforts to apply water treatments.

The EU project DRYvER (H2020-grant agreement 869226-2) is currently exploring the metacommunity structure and implications for functions and services in intermittent river networks. ICRA is in charge of modelling and up-scaling the functions and ecosystem services of intermittent streams to the European scale. The functions include biological processes such as greenhouse gas production, decomposition, and the primary production and respiration of drying river networks. The ICRA team has been tasked with characterising the spatial processes that occur on systems submitted to periodical drying, mostly at a European scale. Dr Margot Sepp has recently joined ICRA as a postdoctoral researcher working on the DRYvER project to perform these tasks.

Lastly, we started the TED project “City run-off pollution impacts on river biodiversity under extreme climatic events (CityPoll)”. CityPoll combines 3 sub-projects: sub-project 1 (ICRA) focuses on hydrology, chemistry and their effects on biofilms; sub-project 2 (UB) focuses on ecotoxicological effects on invertebrates and the emission of greenhouse gases; sub-project 3 (EHU) focuses on ecosystem functioning and the mitigating effects of buffer areas. ICRA’s sub-project is a collaboration between the three research areas of the institute. Our sub-project aims to determine the impact of run-off from impervious urban surfaces on local hydrology and pollutant inputs, whose effects on receiving river ecosystems are not widely known. CityPoll addresses this information gap through multidisciplinary research combining hydrology, environmental chemistry, ecotoxicology and ecology.

R&E4. FRESHWATER-RELATED ECOSYSTEMS SERVICES & NATURE-BASED SOLUTIONS

In 2022, five research projects were undertaken: three basic research projects (EESAM, SANNAT and MERLIN) and two applied projects (TRACE and WIAT), which are described in the transfer section.

The EESAM (Management of Ecological Status and Environmental Services for the Design and Prioritisation of Management Measures) is a joint research project with the Catalan Water Agency (ACA) to develop a decision-making aid system so that basin managers can determine which actions will have a better cost-benefit ratio, considering, as benefits, ecological improvements and an increase in ecosystem or environmental services. The project basically consists of four blocks: one on the development of biophysical models, a second one that works on determining the benefits associated with ecosystem services, a third that considers the design of the aid system itself, and a fourth related to communication, both with society and the technicians from the Autonomous Community, who are the potential users. The main results can be summarised as follows: 1) The SWAT+ model was implemented in internal basins, and a series of processes related to specific discharges were coded; 2) a service assessment scheme was co-developed with technicians from the ACA and biophysical models were linked to the assessment of benefits; 3) the basic strategies for prioritising management measures were defined, and a series of management scenarios were implemented in the

results transfer phase; and 4) a dissemination video on the relevance of environmental services in basin management was produced.

SANNAT is a joint project carried out with other research institutions or companies around the world aimed at the implementation of nature-based solutions for wastewater treatment. The project is funded by The Nature Conservancy, the Wildlife Conservation Society and the NCEAS synthesis centre (all 3 institutions are based in the United States of America). The Technologies and Evaluation and Resources and Ecosystems Areas led ICRA’s participation in the project, which will continue beyond 2022 within the framework of the MULTISOURCE EU Green Deal project, in which the two aforementioned areas of research also participate.

The MERLIN project (Building a low-carbon, climate-resilient future: Research and innovation in support of the European Green Deal), funded by Horizon 2020, started at the end of 2021 and has defined the main objectives of the work undertaken at ICRA. The Resources and Ecosystems Area participates in the assessment of ecosystem services in one of the case studies, and we will also develop a scale model to estimate the demand for ecosystem services and determine the best places to carry out river restorations.

TECHNOLOGY TRANSFER

Project AQUIFER (INTERREG-SUDOE): aims to identify and characterise potential Innovative Practices in Groundwater Management that may offer interesting potential for replication in the context of the SUDOE territory. Under a contract with the Catalan Water Partnership (CWP), a study of the most promising practices was conducted following a detailed survey of examples from the SUDOE region, as well as other places in the world. Each one was described, and the compendium of these summaries will be published as a project deliverable. RiE has overseen the selection of the innovative practices and the description of their outcomes. Principal Investigator: Josep Mas Pla.

TRACE: a contract with the Catalan Water Agency (Analysis of the potential for improving urban sanitation and traceability studies of industrial pollution sources and emerging pollutants), which began in 2021 and ended in July 2022. During the first half of 2022, the final reports were prepared, and in the second half of 2022, the work focused on transferring the technology to the different relevant departments of the Catalan Water Agency, which culminated in a meeting attended by the directors of those departments and the head of the Agency. The results will be published in a series of scientific publications in 2023 and probably 2024. Principal Investigators: Vicenç Acuña, María José Farré and Wolfgang Gernjak

WIAT: a contract with the World Business Council for Sustainable Development, which began in 2021 and has continued throughout 2022. During the course of 2022, an online tool was developed to determine the impacts of industries on three key aspects: climate change, local water security, and biodiversity. The tool was co-developed with a group of users, reviewed by a committee of experts, and is now available to members of the World Business Council. During the last months of 2022, work was carried out on version 1.2 of the tool, integrating the response of multiple users, and preparing it for presentation at the UN 2023 Water Conference in New York in the Spring of 2023. Principal Investigator: Vicenç Acuña and Lluís Corominas.

REFCON: project lead by TRAGSATEC that aims to define the biological communities in reference sites of fluvial systems throughout the Iberian Peninsula. The main aim of the project is to compare the present river typologies from those derived from the present scrutiny of communities (including algae, macrophytes, invertebrates and fish). ICRA is currently advising on the data interpretation and summary, working on an integrated assessment to the Ministry (Ministerio de Transición Ecológica y Reto Demográfico). Principal Investigator: Sergi Sabater

AI - PHD DISSERTATIONS

Montes-Pérez, Jorge. Carbon flows in reservoirs under a changing hydrology scenario. University of Málaga, 2022. Co-director: R. Marcé.

AI - VISITING SCIENTISTS

Ari, Akif - Bolu Abant Izzet Baysal University

Calsamiglia Reguant, Aleix - University of the Balearic Islands

Erturk Ari, Pelin - Bolu Abant Izzet Baysal University

Gultemirian, Lourdes - Instituto Biodiversidad Neotropical (Ibn)

Montes Perez, Jorge Juan - Universidad de Malaga

AI - VISITING STUDENTS

Benito Guasch, Abel - University of Girona (Udg)

Comalada Pla, Francesc - University of Girona (Udg)

Cutillas Galindo, Marc - University of Girona (Udg)

Di Grazia, Francesco - University of Siena

Mecias Herrera, Nelson Luis - University of Girona (Udg)



▶ WATER QUALITY AND SAFETY

LINES

- ▶ QS1. CHEMICAL CONTAMINANTS AND MICROPLASTICS IN THE AQUATIC ENVIRONMENT
- ▶ QS2. CHEMICAL CONTAMINANTS IN WATER TREATMENTS
- ▶ QS3. WATER MICROBIOLOGY
- ▶ QS4. WATER AND HUMAN HEALTH

1 Technical Support Person
Núria Càceres

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1 Research professor (ICREA associated)
Mira Petrović

1 Research professor (CSIC associated)
Damià Barceló

1 Research professor (UdG associated)
Carles Borrego

3 Research Scientists

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Sara Rodríguez Mozaz

Maria José Farré

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Meritxell Gros Calvo

Victoria Francisca Osorio Torrens

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Mira Celic

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Elisabet Sañe Schepisi

Marta Turull Lopez

Ana Carolina Maganha de Almeida

Marie Rescan

Oriol Sacristan Soriano

Laura Guerrero Latorre

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Angela Isabel Pedregal Montes

Nonito Ros Berja

Barbara Topolovec

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Natalia Saez Rosique

Aina Cuixart Gimo

Elisa Garcia Gomez

David Gascon Trullols

Alejandro Margareto Mato

Saida Marti Garcia

Miyako Nitta

Alejandro Sanchis Richart

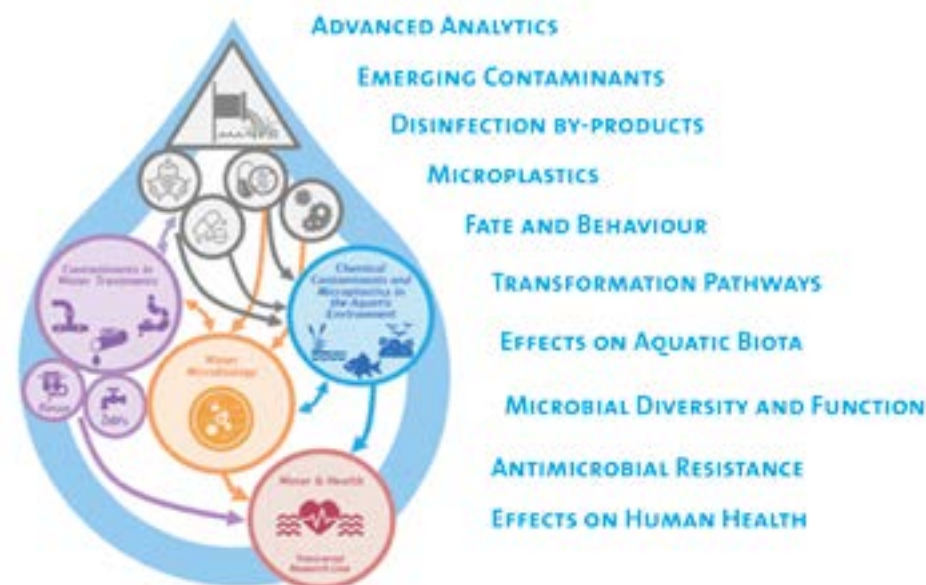


WATER QUALITY & SAFETY RESEARCH AREA

The research conducted at the Water Quality and Safety Area follows four main lines:

- Chemical contaminants and microplastics in the aquatic environment,
- Chemical contaminants in water treatments,
- Water Microbiology, and
- Water and Human Health.

The main activities and results obtained in 2022 within these four research lines are summarised below.



Q1. CHEMICAL CONTAMINANTS AND MICROPLASTICS IN THE AQUATIC ENVIRONMENT

Emerging pollutants in water reclamation: treatment of wastewater and greywater with nature-based solutions (NBS) and advanced oxidation processes (AOPs)

The performance of different wastewater treatment trains in terms of removing pharmaceutically active compounds (PhACs) and endocrine disruptors (EDCs) was evaluated within the framework of the **ReUseMP3** project "Integrating nature-based water ReUse strategies with advanced Monitoring of the Presence and impact of MicroPollutants and MicroPlastics" (AEI-MCIN PID2020-115456RB-I00) and the **HYDROUSA** project "Demonstration of water loops with innovative regenerative business models for the Mediterranean region" (EU Grant Agreement No. 776643). In addition to evaluating the removal of target compounds, we studied their fate in the water-soil-plant system after using reclaimed water to irrigate agricultural fields. Special

attention was paid to the rhizosphere microbiota, where a combined approach using target and non-target methodologies was adopted based on liquid chromatography coupled to a mass spectrometer LC-MS/MS or to a high-resolution mass spectrometer (LC-LTQ-Orbitrap-MS/MS) respectively. Using these methodologies, we assessed the presence of pollutants of interest and the alteration to the metabolome of the microbial community (metabolomics approach) in the rhizosphere.

The evaluation of pollutant removal after treatment with advanced oxidation processes based on UV/H₂O₂ is also tackled in the project **LIFE-RECYCLO**, "RECYCLing Wastewater from Small and Medium-sized Laundries Using an Advanced Oxidation Process" (EU LIFE 2020 programme. Code: LIFE20 ENV/FR/000205), in which a prototype has been designed to recirculate the water in laundry facilities. Target analytical methods based on a liquid

chromatography system coupled to a mass spectrometer LC-MS/MS were upgraded in 2022 to determine selected contaminants in laundry greywater, including pharmaceuticals, antimicrobials, preservatives, flame retardants, plasticisers, and other plastic additives, among others. An analytical methodology based on GC-MS/MS was specifically developed to analyse the phthalate DEHP in such effluents. Laundry effluents were characterised in 2022 using these methodologies and will be used in 2023 to assess the performance of the prototype to be installed in laundry facilities.

Occurrence and distribution of emerging pollutants in the natural environment

Among the pharmaceutical compounds, antibiotics, a specific family of compounds, have a high consumption rate and are a cause for environmental concern. The study of the distribution of antibiotics in the marine environment, which is impacted by aquaculture facilities and their link to antibiotic resistance in the environment, is one of the main tasks of the **ARENA** project on "Antibiotic RESistaNce and Pathogenic Signature in Marine and Freshwater Aquaculture Systems" (AEI-JPI: PCI2021-121929). In the summer of 2022, the first sampling campaign took place at a selected site on the Mediterranean coast of Italy (Porto Venere), where water, sediments, and aquatic organisms (fish and benthic biota) were collected. The samples are currently being processed at ICRA for their subsequent analysis.

The presence of antibiotics, together with other selected pharmaceuticals, was also studied in freshwater ecosystems in Argentina through collaboration with the University of Luján. In this study, we evaluated the distribution of PhACs in surface waters and the biota of different trophic levels. Around thirty compounds were detected at least once in water, fluvial biofilms, or macrophytes. Significant bioaccumulation factors (>1000 L/kg d.w.) were obtained for the psychiatric drug venlafaxine and the antibiotic ciprofloxacin in biofilm, which is considered the most suitable biota matrix to monitor the immediate reception of PhACs in biota and relate it to the so-called urban stream syndrome.

In 2021, the distribution of the plasticiser bisphenol A (BPA), as well as some of its analogues (Bisphenol S, B, F, AF and Tetrabromobisphenol A), was studied in a monitoring study in the Delta Ebro (Spain) within the framework of the **PLAS-MED** project on "Microplastics and Micropollutants on the Mediterranean Coast: Toxicity and Impact on the Environment and Human Health" (MINECO CTM2017-89701-C3-2-R). However, the results were only published in 2022. Water samples (wastewater, river water, and seawater), fluvial biofilm and fish and biofluids (fish plasma) were evaluated for the presence of these compounds. In addition, plastic litter was collected to evaluate its role as a potential source of bisphenols. An analytical method based on liquid chromatography coupled to mass spectrometry

(LC-MS/MS) was developed to analyse these compounds in all the environmental compartments considered. While Bisphenol S and BPA were detected in water and, to a limited extent, in biota, less polar analogues (mainly BPAF and TBBPA) were not found in any of the water samples but were found in fish tissues and biofilm. Biofilm demonstrated its potential as a sentinel of chemical contamination in the freshwater environment, concurring with the findings of the study reported above in Argentina.

Evaluation of the effect of microplastics on the impact of organic micropollutants in aquatic organisms

New emerging pollutants, such as microplastics and nanoparticles, can act as carriers of organic contaminants and alter their impact on aquatic organisms. The **PLAS-MED** project on "Microplastics and Micropollutants on the Mediterranean Coast: Toxicity and Impact on the Environment and Human Health" (MINECO CTM2017-89701-C3-2-R), which closed in 2021, aimed to study the role of microplastics in the transference, bioaccumulation, and toxicity of pharmaceuticals and other emerging pollutants in aquatic organisms. As part of the project, the impact of microplastics on the bioaccumulation and biotransformation (including the spread of antibiotic resistance) of antibiotics and bactericides in river biofilms was evaluated through mesocosm experiments, with the corresponding papers being prepared in 2022. As a follow-up to the project, a collaboration was set up with the University of Montpellier (France), where a metabolomics approach was applied in 2022 to the samples generated during the PLAS_MED mesocosm experiments. In these experiments, also carried out in collaboration with the Spanish Oceanographic Institute (IEO) in Murcia, the effect of polythene microplastics on the bioaccumulation of citalopram and bezafibrate in mussels, as well as related metabolomic alterations after 21 days of exposure were studied.

Q2. CHEMICAL CONTAMINANTS IN WATER TREATMENTS

Study of the occurrence, fate and elimination of emerging contaminants in engineered systems

Within the H2020 MSCA ITN-EJD project **NOWELTIES** - Joint PhD Laboratory for New Materials and Inventive Water Treatment Technologies. Harnessing resources effectively through innovation, the group is involved in studying the elimination of recalcitrant organic micropollutants (OMPs) in treatments based on advanced oxidation processes (AOP), such as non-thermal plasma. The main objective of this study is to evaluate the elimination and to elucidate transformation pathways of selected recalcitrant perfluorinated compounds within the group called PFAS: Perfluoro-2-methyl-3-oxahexanoic acid (HFPO-DA/GenX), Perfluorooctanoic acid (PFOA), Heptadecafluorooctanesulfonic acid (PFOS), Undecafluorohexanoic acid (PFHxA), Tridecafluorohexane-1-sulfonic acid (PFHxS), Perfluorobutyric acid (PFBA), Nonafluorobutane-1-sulfonic acid (PFBS), dodecafluoro-3H-4,8-dioxanate (ADONA). Non-thermal plasma in liquid and gas-liquid environments generates in situ oxidising species, such as hydroxyl radicals, ozone, hydrogen peroxide, peroxy nitrates, etc., capable of degrading recalcitrant OMPs from the solution relatively quickly, and even using low power discharges. This oxidative breakdown is influenced by the scavenging capacity of matrix components, resulting in the accumulation of transformation products (TPs) rather than complete mineralisation.

During 2022, the research conducted included target and non-target analysis using LC/MS (UPLC-Qtrap) and LC-HRMS/MS Orbitrap Exploris 120 to study kinetics and identify the transformation products (TPs) formed during plasma treatment, as well as conducting a risk assessment of chemical species and TPs of PFAS. The results show that plasma can degrade both TPs and parent compounds in the "best-case scenario" or completely remove parent compounds in distilled water without a detectable formation of TPs, while in more complex matrices (tap water and WWTP effluent), longer treatment time is needed. As a second task, a risk assessment of chemical species and PEAS transformation products was conducted in collaboration with the University of Ferrara, Italy. The available data on toxicity was collected for more than 50 PFAS compounds to establish the methodology for PBT risk assessment for PFAS, elaborate the prioritisation list, formulate predictions based on PBT properties, evaluate and calculate the toxicity of PFAS parent compounds and their possible transformation products and identify major obstacles and data gaps in the PBT PFAS approach.

Within the framework of the H2020 project **EMERGE** (project no. 874990), which evaluates the impacts of shipping emissions in Europe, our efforts have been focused on analysing the most relevant organic contaminants in the wastewater effluents (e.g., scrubber discharge and greywater) that are discharged from ships into the marine environment.

During the course of this year, scrubber and seawater samples from different geographical regions with heavy marine traffic were analysed for the occurrence of polycyclic aromatic hydrocarbons (PAHs) and alkyl-PAHs. The studied sites included the Öresund Strait in Sweden, the Saronic Gulf in Greece and samples from an on-board case study in a cargo ship travelling from Belgium to Turkey. In addition, the scrubber and seawater samples were also analysed to support eco-toxicological studies and assess the impact of scrubber discharge on autochthonous marine species. The results showed that PAHs and alkyl PAHs were almost undetectable in any of the seawater samples. However, high concentrations of both the parent and alkyl-derivatives were found in scrubber water samples, with naphthalene and phenanthrene being the compounds detected at the highest levels (from 6 to 18 µg L⁻¹), followed by fluorene, acenaphthene, and pyrene (0.3-1.6 µg L⁻¹). Regarding the alkyl PAHs, C1, C2, and C3 naphthalene and phenanthrene, and C1 and C2 fluorene were the most relevant in terms of concentration and ubiquity, with concentrations ranging from <5 up to 15 µg L⁻¹, depending on the substances.

In addition, an analytical workflow based on liquid chromatography coupled with high-resolution mass spectrometry (LC-HRMS) was developed for the wide-scope screening (>1000 emerging contaminants) of scrubber and greywater effluents. Samples from different cargo ships docked at Helsinki Port were provided by the Baltic Sea Action Group and analysed with the developed methodology. The aim is to identify the most relevant organic contaminants, other than PAHs, present in both scrubber and greywater effluents, including industrial chemicals, personal care products, pharmaceuticals, etc., that could be hazardous for marine ecosystems.

Sources, fate and risks of organic contaminants in agroecosystems

In 2022, two projects funded by the Cooperation for Innovation: Operational Groups, Rural Development Program of Catalonia 2014-2022 of the Catalan Government's Ministry of Climate Action, Food and

Rural Agenda (DACC) were granted. In the project **REAQUA**, "Innovative strategies for water reuse in the meat industry: assessment of the technical, economic and regulatory constraints required to ensure safe use and the creation of a technical guide for reference", led by Olot Meats SA and coordinated by INNOVACC, the efficiency of innovative slaughterhouse wastewater treatments (membranes and advanced oxidation processes) will be evaluated. In **FERTIECO**, "Implementation of hyperthermophilic composting for the production of organic fertiliser from the solid fraction of pig slurry", also coordinated by INNOVACC and led by Agropecuària Catalana SCCL, the potential of hyperthermophilic composting will be assessed to produce a bio-based fertiliser from pig manure suitable for organic farming. In addition, the characteristics of this fertiliser will be compared with others (e.g. from cattle manure) that are currently fit for this purpose. Both projects will be performed in collaboration with the Microbiology group at ICRA, and the removal of pharmaceuticals, antibiotics, and antibiotic-resistance genes will be evaluated in the different treatments.

Another new project started in 2022 was the **REMEDIATE-EMFASIS** (TED2021-131005B-C31), "Transport of organic contaminants in groundwater under in-situ remediation conditions", funded by the national Ecological and Digital Transition call and coordinated by the University of Barcelona. ICRA's subproject, EMFASIS, which is run in collaboration with the Resources and Ecosystems (RiE) Area at ICRA (PRs J. Mas-Pla and M. Gros), will focus on studying the fate of emerging contaminants in groundwater under in-situ remediation actions aimed at reducing nitrate inputs in the Mar Menor lagoon area. A new PhD thesis started this year, aimed at developing innovative wide-scope screening methodologies to be applied in groundwater quality assessment. The first studies were performed in the Onyar River basin, where the sources, occurrence and transport of pharmaceuticals in groundwater are being evaluated. Also, within the topic of groundwater pollution, a public tender contract funded by the Catalan Water Agency was obtained to monitor the occurrence of emerging contaminants (pharmaceuticals, antibiotics and perfluoroalkyl substances) in groundwater samples in areas under urban, industrial, and agricultural influence in Catalonia.

Other activities in 2022 include collaborations with the Department of Chemical Engineering at the University of Coimbra (Portugal) and with the Technologies and Evaluation area (TiA) at ICRA to assess the removal of pharmaceuticals and antibiotic-resistance genes in livestock and activated sludge treatment. For livestock wastewater, the potential of Fenton treatment combined with novel adsorbents and

catalysts was evaluated, while at TiA, the performance of graphene oxide addition to the anaerobic digestion of sewage sludge was investigated, resulting in a joint publication. Furthermore, the potential of plants (*Salvinia minima*) to reduce pharmaceutical and antibiotic loads in livestock wastewater was evaluated through a collaboration with Dr. Maria Jesus Lami from the National University of Tucuman (Argentina) and Dr Sara Rodríguez-Mozaz at ICRA. This year, the ongoing collaborations with the Swedish University of Agricultural Sciences (SLU) in Sweden and the Instituto Nacional de Investigación Y Tecnología Agraria y Alimentaria (National Institute of Agricultural and Food Research and Technology) of the Spanish Council for Scientific Research (INIA-CSIC) in Madrid continued. These collaborations evaluated the environmental risks of blackwater fertilisation in agricultural fields, and the toxicity of selected antibiotics to wild and cultivable plant species and their effects in the dissemination of antibiotic resistance, respectively.



Q3. WATER MICROBIOLOGY

PhageLand

The JPIAMR project **PhageLand** (Phage treatment and wetland technology as intervention strategy to prevent dissemination of antibiotic resistance in surface waters, Ref. PCI2021-122109-2A) officially started on the 1 February 2022. As coordinators of the project, we organised the kick-off meeting that was held online on the 6 April. We also had the opportunity to present PhageLand to the JPIAMR committee and the other funded project coordinators during the HARISSA projects start-up meeting held online on the 28 April. One of the activities carried out by our team was the sampling of the Empuriabrava constructed wetlands (CW) to assess the capacity of a model full-scale CW to remove antibiotic residues, antibiotic-resistant bacteria (ARB) and associated antibiotic-resistance genes (ARGs). The sampling was carried out over four consecutive days in late July when we collected wastewater samples at the influent of the Empuriabrava WWTP and the different lagoons along the treatment train. We also collected samples from zooplankton and sediments from the lagoons to evaluate the contribution of these compartments to the accumulation of ARB and ARGs. The samples were processed at ICRA's facilities and sent to Poland for metagenomic sequencing (Institute of Microbiology, University of Warsaw). Also, the Moldovan partner (Nicolae Testemitanu State University of Medicine and Pharmacy, NTSU) collected samples from the Orhei CW that were also sent to the UW for molecular analysis. In parallel, the NTSU prepared a collection of ARB isolates that were sent to the partners in Belgium (KU Leuven) and the UK (Quadram Institute Biosciences) to begin the identification and characterisation of phages specific to the ARB of interest.

On the 19 September, ICRA held a first face-to-face meeting where all the partners came together and presented their first results. The meeting also allowed for a fruitful discussion on upcoming tasks and dissemination activities.

Implications of bacteriophages on the dissemination of antibiotic resistance

Bacteriophages (phages) are the most abundant biological entities in the biosphere, with an estimated population of 1030–1032. Their considerable abundance and ubiquity make them one of the most efficient vehicles for moving genes between their bacterial hosts. Although discovered more than 60 years ago, the contribution of phages to horizontal gene transfer is still a topic worthy of further research. In fact, questions such as to what extent phage-mediated horizontal gene transfer contributes

to environmental antibiotic resistance remain unanswered. To shed some light on this topic, Dr Ana de Almeida Kumlien and Dr Edgar González joined our research group as postdoctoral fellows to explore the factors that promote phage-mediated horizontal transfer of antibiotic-resistance genes (ARGs), and their activities were supported by the European Commission (**ENVIROSTOME** project) and the Society for Applied Microbiology. Among the results, we can highlight that while a higher abundance of ARGs was found in bacterial DNA fractions from river sediment samples, ARGs, particularly those conferring resistance to sulfonamides and tetracyclines, were also detected in phage DNA fractions. Moreover, we have demonstrated for the first time that phages can promote the conjugative transfer of plasmid-mediated ARGs as a result of a phage-induced stress response. These findings suggest that the role of phages in the dissemination of ARGs could be more significant than previously expected.

Role of migratory birds in the dissemination of antibiotic-resistance genes

The **DARABi** project (ref. PID2019-108962GB-C22, State Research Agency, Ministry of Science and Innovation) aims to determine the role of migratory birds in the dissemination of antibiotic resistance. During the second year of the project, we collected faecal samples from lesser black-backed gulls (*Larus fuscus*) and white storks (*Ciconia ciconia*) at paddy fields and landfills with diverse pollution levels in Andalusia and analysed them for bacterial community composition and ARG content of ARG using 16S rRNA gene sequencing and high-throughput qPCR (HT-qPCR), respectively. Overall, the faecal microbiomes of both bird species were compositionally different and bacterial communities from landfills were richer and more diverse (in the case of gulls) than those from less polluted sites (Dehesa de Abajo paddy fields). We also observed higher relative abundances of ARGs conferring resistance to tetracyclines, beta-lactams and sulfonamides in the faeces from birds inhabiting higher anthropised sites than those from wetlands. Remarkably, faecal samples from the landfill seemed to be enriched in potential pathogens, suggesting that human waste is the likely source of potential pathogenic bacteria. This work demonstrates that the frequent use of anthropised habitats by gulls and storks favours the enrichment of ARGs in their guts, which can then spread over long distances across their migratory routes. We are currently analysing the results from a guanotrophication experiment to assess the contribution of bird faeces to the richness and abundance of ARGs in natural biofilms.

Q4. WATER AND HUMAN HEALTH

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

A new Horizon Europe project coordinated by ICRA (MJ Farré) "**intoDBP**: Innovative tools to control organic matter and disinfection by-products in drinking water" No-101081728 HORIZON-CL6-2022-ZEROPOLLUTION-01 with a total funding of €3,994,707 started in December 2022. The aim of the project is to create innovative tools and strategies to improve water quality management for safe human use and a healthy environment. It focuses on catchment protection and forecasting, transformative drinking water treatment, and real-time monitoring to combat the effects of climate and global change. In particular, intoDBP focuses on pollution and risks related to disinfection by-products (DBPs). By developing and applying advanced, integrated, and cost-effective sensors and analytical methods, intoDBP will expand knowledge on water quality and DBP precursors to better understand its formation and human exposure in Europe. intoDBP monitoring results will feed into numerical forecasting tools to predict source water changes and formulate climate change adaptation pathways at catchment and treatment scales. intoDBP also develops transformative options for the advanced and cost-effective upgrade of water treatment and disinfection.

Additionally, we have been working on the already funded projects **waterDOM** (No-PID2020-114065RB-C21) and **Scan2DBP** (No-PDC2021-121045-I00). In particular, the WaterDOM subproject "small-molecule mass spectrometry fingerprinting as a diagnostic tool in water quality surveillance and treatment optimisation" aims to provide rigorous analytical methods and tools for the holistic characterisation of water samples based on high-resolution mass spectrometry (HRMS) fingerprinting of the dissolved organic matter (DOM). WaterDOM validates mass spectrometric approaches for the characterisation of DOM profiles through (waste)water treatment to estimate and optimise treatment efficiency and investigates changes in drinking water sample fingerprints to predict treatment side effects such as the formation of DBPs. Dr Mira Celic has been working on this project. With similar objectives, the group collaborates with the University of Lille in the NOMIC ANR JCJC 2021 project, Natural Organic Matter Innovative Characterisation and Transformation By-product Prediction. The proof-of-concept project, Scan2DBP, "A scanning dissolved organic matter fingerprint tool to predict disinfection by-product formation during water treatment", aims to promote and accelerate the transfer of knowledge and results obtained from the already completed NDMA_predict project CTM2017-85335-R "How to predict and minimise NDMA formation in drinking and recycled water with advanced analytical techniques". The main objective

of Scan2DBP is to create an application that can be used as an early warning system to predict DBPs during water disinfection based on the organic matter fingerprint obtained with HRMS. The initial results on predicting NDMA have already been published. The postdoctoral researcher Patricia Aguilar Alarcon has been assigned to this project.

Also, during this year and in collaboration with the Resources and Ecosystem Area, we have been working on the **Traça** project, which is funded by a public tender process awarded by the Catalan Water Agency to monitor the source of contaminants and DBP precursors in Catalan catchments. Within this project, we have found that industries are a major source of priority pollutants and emitters of DBPs such as nitrosamines and their precursors. We also have been finishing the experimental part of the Transfer contract with **Canal de Isabel II**, which aims to investigate the source of nitrosamines in drinking water production using chloramines as disinfectants.

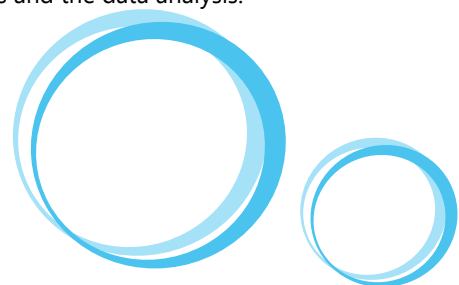
Finally, the group is also part of the **inventWater** network MSCA-ITN-ETN-No 956623 "Inventive forecasting tools for adapting water quality management to a new climate", coordinated by researchers from Resources and Ecosystems at ICRA, where we investigate forecasting approaches for catchment characterisation and prediction of DBP formation during drinking water production in Angela Pedregal's PhD.



Wastewater-based epidemiology of SARS-CoV-2 and other pandemic viruses

We have been participating in the **VirWASTE** project (2021-22) funded by the AGAUR within the framework of the call PANDEMICS ("Retreating to grow: the impact of pandemics in a world without visible borders"). VirWASTE was coordinated by the "Virus Contaminants in Water and Food" group at the UB, and ICRA is involved through the participation of different researchers from the TiA and Quality areas. The main aim of the project, which closed in November 2022, was to provide mechanisms of anticipation and rapid response tools (alert system, predictive tools, adoption of evidence-based measures) for health authorities in order to better manage future pandemic threats. During the past two years, ICRA has developed a series of standard operational protocols for the proper and efficient sampling of urban sewers; SARS-CoV-2 abundance in wastewater was monitored in three neighbourhoods in Barcelona, each differing in their socio-economic statuses, and in one hospital. Furthermore, we linked SARS-CoV-2 data obtained from sewage to an epidemiological model; said link allows us to validate epidemiological models, a task that will become relevant when new COVID-19 cases are no longer being reported. We also worked on optimising the existing sewage monitoring platform to transform it into a Digital Epidemics Observatory, and we have developed a statistical tool based on Principal Component Analysis designed to automatically detect outbreaks at a city level.

In addition, we are participating in the **EpiSARS** project (2021-2023) funded by the TV3 fund-raising marathon to assess the efficacy of wastewater-based epidemiology at a building scale, comparing different wastewater sampling approaches. During 2022, we conducted several sampling campaigns in 6 buildings (2 care homes for older adults, 2 primary schools, 1 university dormitory and 1 university campus) using both a standard and a novel sampler device (i.e., automatic samplers and 3D printed plastic torpedoes, respectively), and participated in analysing the collected wastewater for SARS-CoV-2. EpiSARS has the participation of Mrs Anna Pico and Mr Sergi Badia, who are involved in the sampling campaigns and the data analysis.



Catalan Surveillance Network of SARS-CoV-2 in sewage (SARSAIGUA)

During 2022, the Catalan Institute for Water Research (ICRA) has continued the coordination of the Catalan Surveillance Network of SARS-CoV-2 in sewage (SARSAIGUA). The network, which was set-up in July 2020, has monitored 56 WWTPs evenly distributed across the Catalan territory, covering 80% of the Catalan population. After two and a half years of weekly monitoring (from July 2020 to December 2022), SARSAIGUA has analysed approximately 5,400 samples. On average, the results have been reported 2.37 ± 0.66 days after sample collection. The daily load of SARS-CoV-2 markers in the 56 WWTP monitored has been relatively in line with the sum of COVID-19 cases during the successive pandemic waves, including the 6th wave caused by the rapid surge of Omicron cases during December 2021 (**Fig. X**). Overall, a good fit was obtained between the viral load (GC/day) and the evolution of diagnosed cases in the municipalities served by the WWTPs monitored (Spearman correlation coefficient = 0.69). The segregation of data between large (serving >150,000 PE) and small (<150,000 PE) WWTPs yielded a similar fit (Spearman correlation coefficient = 0.51 and 0.62 for large and small WWTPs, respectively) (see bottom panels in **Fig. X**).

In November 2021, SARSAIGUA began monitoring SARS-CoV-2 variants by sequencing sewage samples every two weeks using Oxford Nanopore Technology and ARCTIC Primers targeting the S gene. The use of this sequencing method allowed the tracking of the territorial introduction and expansion of the Omicron variant as well as the concurrent decline of the Delta variant (**Figures Y and Z**).

In 2002, we published an open-access paper describing the full roadmap for the implementation and deployment of SARSAIGUA (Guerrero et al., 2022, Sci. Reports 12:16704; DOI: <https://doi.org/10.1038/s41598-022-20957-3>). All data generated are open-source and have been updated weekly and stored on the Zenodo website (<https://doi.org/10.5281/zenodo.4147073>).

SARSAIGUA is a collaborative project promoted and funded by the Catalan government's Public Health Agency of Catalonia (ASPCAT) and Catalan Water Agency (ACA). The laboratories involved in the surveillance network are: i) the Laboratory of Enteric Virus, led by Prof A. Bosch and Prof R. Pintó (UB, Barcelona); ii) the Laboratory of Virus Contaminants of Water and Food, led by Prof R. Gironés and Dr S. Bofill (UB, Barcelona); and iii) the Centre for Omic Sciences within the Biotechnology Area of the Eurecat Technology Centre (Reus, Tarragona).

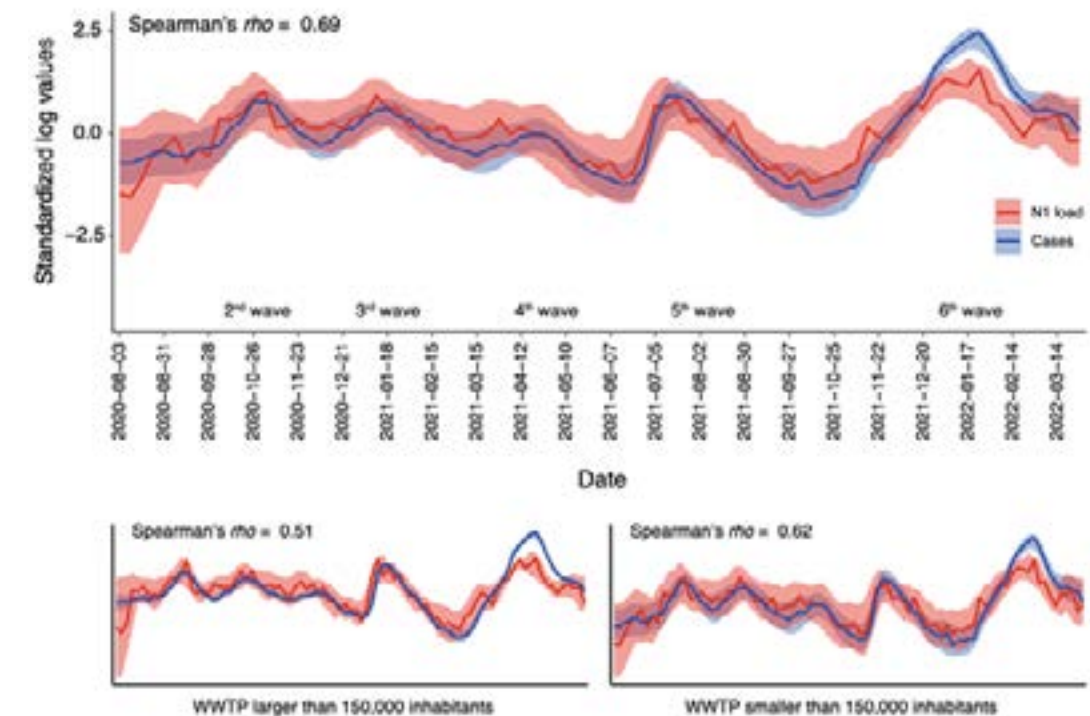


Figure X. Timeline of SARS-CoV-2 standardised load in sewage (red) and diagnosed COVID-19 cases (blue) for each sampling data across all WWTP from August 2020 to March 2022 (after April 2022, the reporting of cases was discontinued by the health authorities). Shaded ribbons represent the corresponding standard deviation values for each sampling date. The standard deviation values for each sampling

date were smoothed using a rolling average with a window of 3 observations. The graphs below show the same timeline when segregating viral loads and cases for large (>150,000 inhabitants, left) and small (<150,000 inhabitants, right) WWTPs. The Spearman Rho correlation coefficients are shown. Image source: Guerrero et al. 2022, Sci. Reports 12:16704; DOI: <https://doi.org/10.1038/s41598-022-20957-3>).

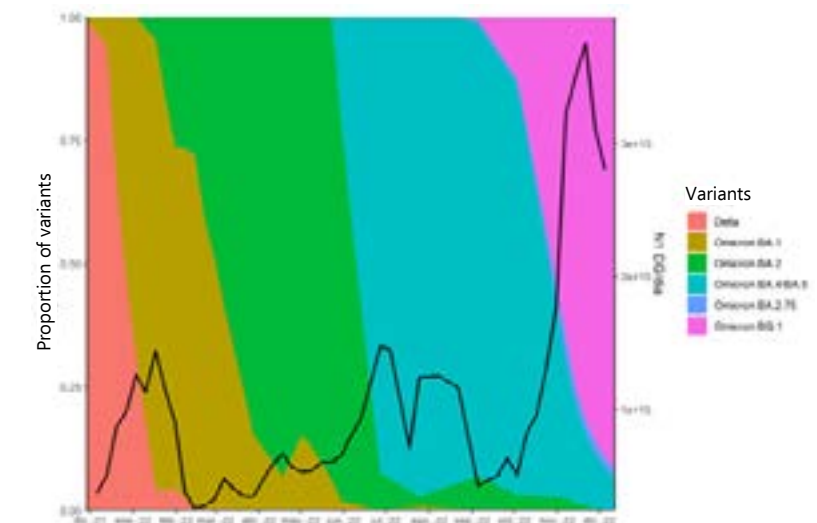


Figure Y. Dynamics of the accumulated daily viral load normalised for all WWTPs (black line, right axis) and the proportion of the identified SARS-CoV-2 variants in sewage (see legend) during the surveillance period (December 2021–December 2022).



Figure Z. Maps showing the spatial distribution of the frequency of the identified SARS-CoV-2 variants at each WWTP monitored between June 2022–December 2022 (weeks #2022.26 and #2022.50). Colours refer to the detection frequency (from 0 = pale orange to 1 = deep purple; pinkish white = not detected).

TECHNOLOGY TRANSFER

- ✓ **TRACE:** Transfer contract with the Catalan Water Agency (ACA) and in collaboration with RiE. Traceability of priority substance contamination sources and emerging pollutants in relevant river sections, and measures to improve urban sanitation in Baix Llobregat. CTN2000533. Principal Investigators: Vicenç Acuña, María José Farré and Wolfgang Gernjak.
- ✓ **NDMA:** Transfer contract with Canal de Isabel II. Study of NDMA formation in drinking water treatment plants and removal of NDMA precursors. CONTRACT No. 88/2018. Principal Investigator: María José Farré.

- ✓ **CSIR:** Contract with the Council for Scientific and Industrial Research (CSIR) – South Africa, RFP No 3404/13/11/2020 – Pharmaceutical compound analysis on freshwater, seawater and wastewater on an as-and-when-required basis to the CSIR. Principal Investigator: Mira Petrovic.
- ✓ **ACA priorities:** Public tender contract CTN2200303 with the Catalan Water Agency (ACA). Analysis of priority substances and other contaminants, preferential substances and emerging contaminants in surface water and groundwater in Catalonia during the period 2022-2024: Monitoring and determination of emerging contaminants in groundwater. Principal Investigators: Meritxell Gros and Mira Petrović.
- ✓ **Collaboration with INIA-CSIC.** Analysis of antibiotics in water and soil samples from plant toxicity tests. Principal Investigators: Sara Rodríguez-Mozaz, Meritxell Gros.



All - VISITING SCIENTISTS

- Alonso, Lucas Leonel** - ICYTAC
- Castro Varela, Gabriela** - Norwegian University of Science and Technology
- Gonzalez Villalobos, Edgar** - UNAM
- Jaen Gil, Adrian** - NORCE
- Lami, Maria Jesus** - INBIOFIV
- Previsic, Ana** - University of Zagreb
- Rozman, Marko** - Ruder Boskovic Institute

All - VISITING STUDENTS

- Duconge, Bastien** - University of Poitiers
- Sunyer Guiscafne, Ines** - University of Girona (UdG)
- Vazquez, Valeria** - University of the Republic, Uruguay
- Veseli, Marina** - University of Zagreb
- Wang, Zhen** - Nanjing Agricultural University
- Chingate Barbosa, Edwin Antonio** - Technical University of Munich
- De la Rosa, Francis** - University of Zagreb

- Fabregat Grau, Joan** - University of Girona (Udg)
- Jarma, Dayana** - University of Cadiz
- Martin Ortega, Laura** - ICRA
- Mercader Gibert, Manel** - University of Girona (Udg)
- Ogayar Mates, Llorenç** - University of Girona (Udg)
- Sabater Mezquita, Arnau** - Pompeu Fabra University

All - STAYS ABROAD

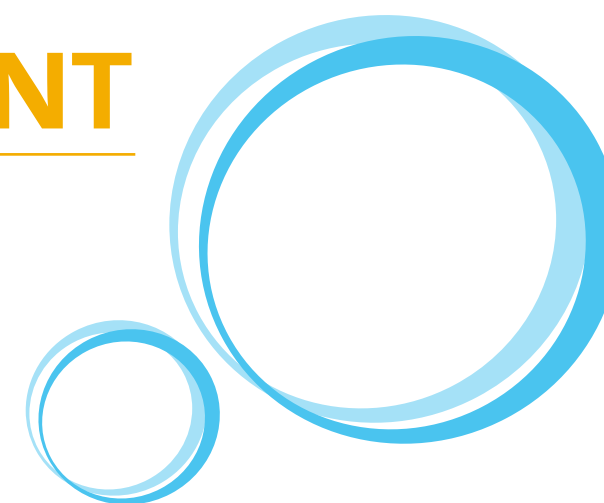
- J. Castaño** – University of Montpellier (France), Prof. Helena Gomez group (from January to May 2022). Metabolomics assessment of mussels exposed to microplastics and microcontaminants.



TECHNOLOGIES AND ASSESSMENT

LINES

- ▶ **T&A 1. CONVENTIONAL AND ALTERNATIVE WATER SUPPLY**
- ▶ **T&A2. WASTEWATER TRANSPORT, TREATMENT AND MANAGEMENT**
- ▶ **T&A3. NEXT-GENERATION AND NATURE-BASED TECHNOLOGIES**
- ▶ **T&A4. MODELLING, ASSESSMENT AND DECISION-SUPPORT FOR URBAN WATER SUSTAINABILITY AND RESILIENCE**



1 Technical Support Personnel

Verònica Rocasalva

41 RESEARCHERS IN THE AREA

Group Leader
Maite Pijuan

1 Research Professor (UdG Associated)
Joaquim Comas

2 Research Professors (ICREA Associated)
Wolfgang Gernjak
Jelena Radjenovic

3 Research Scientists

Gianluigi Buttiglieri
Lluís Corominas Tabares
Maite Pijuan Vilalta

9 Postdoc Researchers

Morgan Abily
Oriol Gutierrez Garcia Moreno
Joana America Castellar Da Cunha
Elisabeth Cuervo Lumbaque
Reynel Martinez Castellanos
Lucia Helena Moreira Dos Santos
Josep Pueyo Ros
Sofia Semitsoglou Tsiapou
Ian Zammit

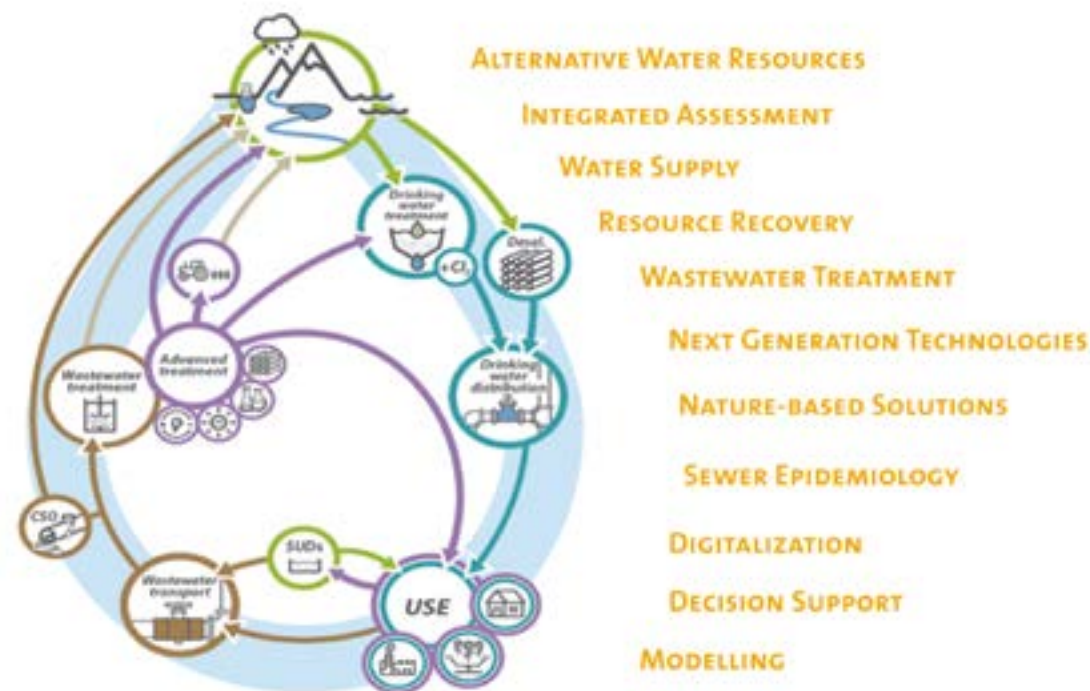
10 Predoctoral Researchers

Oriol Casabella Font
Michele Ponzelli
Marc Castaño Trias
Anna Segues Codina
Nick Duinslaeger
Atefeh Tizchang,
Esther Mendoza Perdiguero
Nikoletta Tsiarta
Natalia Ormeño Cano
Josephine Vosse

16 Research Technicians

Silvia Busquets Font
Sergi Bergillos Pedraza
Lide Jaurrieta Gutierrez
Neus Collado Alsina
Ruben Oncala Mesa
Merce Font Brucart
Laura Aixala Perello
Janick Severijn Klink
Sergi Badia Latre
Anastasya Kravtchenko Babakova
David Martinez Alvarez
Anna Pico Tomas
Adria Riu Ruiz
Maddi Salvoch Vilches
Natalia Sergienko
Nicole Arnaud de Aguiar

TECHNOLOGIES AND ASSESSMENT RESEARCH AREA



T&A 1. CONVENTIONAL AND ALTERNATIVE WATER SUPPLY

This research line focuses on the development of novel processes and treatment trains, mostly focused on physico-chemical treatments and water quality management in these processes. By increasing water supply diversity and including alternative water supply options, we will contribute to increasing system resilience.

Within the research line, several PhD projects have been focusing on different aspects of technology development. For example, as part of the Marie Curie ITN project, Nowelties (coordinated by Mira Petrovic, ICRA AII), the PhD student Nikolett Tsiarta (supervised by Wolfgang Gernjak, co-supervisor Lidija Ćurković, U. Zagreb) continued her PhD thesis on catalytic ozonation using modified ceramic membranes, with the aim of achieving increased micropollutant degradation and decreased membrane fouling. In turn, Amit Kumar (co-supervised by Wolfgang Gernjak) developed and evaluated a lab-scale plasma jet reactor for the abatement of organic microcontaminants (thesis defended in January 2023).

Another 2 PhD projects are being carried out in close collaboration with Wetsus in the Netherlands (www.wetsus.nl), where PhD student Nimmy George Koor (supervisors: Wolfgang Gernjak, ICRA & Bas Wols, Wetsus) is developing novel AOPs making use of the 185 nm and the 254 nm component simultaneously emitted by low-pressure mercury lamps. This PhD project focuses heavily on computational fluid design modelling and reactor design. In 2020, two pilot plants were designed and built and then operated in 2021 at a drinking water production facility in the Netherlands. At the end of 2021, Yicheng Wang (supervisors: Wolfgang Gernjak, ICRA & Bas Wols, Wetsus) commenced her PhD project, which will see her follow-up on Nimmy's work, deepening our knowledge of vacuum UV-initiated chemistry, specifically investigating the application opportunities presented by reductive pathways enabled by the photolysis of water and other reagents. Preliminary experiments in this sense to evaluate the abatement of perfluorinated substances with the UV/sulphite process have already been carried out in 2021 and 2022 by Nour el Houla Slama during her visits to ICRA within the scope of her PhD.

Closely related is the new AEI-funded project reclaimONEwater, "Control of water quality risks in planned and de facto potable reuse". reclaimONEwater will (i) evaluate chemical and biological water quality hazards in planned and de facto potable reuse settings; (ii) develop novel monitoring methods specifically relevant for the validation of treatment barriers; (iii) validate the novel VUV advanced oxidation process in water reuse.

Another technology development project is iWAYS (start 10/2020), funded under the EU H2020 programme with 19 project partners. The project will develop a set of technologies to increase water and energy efficiency in industry through three main solutions: exhaust condensation, water treatment and waste valorisation. iWAYS will consider alternative freshwater sources and develop robust technologies to reduce brine volumes and recycle product water back to the manufacturing process, implementing circular economy principles. The main technology studied by ICRA is membrane distillation and its potential use in the steel manufacturing industry. During 2021 and 2022, the project team around Wolfgang Gernjak and Morgan Abily conducted a detailed analysis of the process and developed a tailored solution for heat and water recovery in the industry. During 2023, the acquisition, installation and start-up of the systems will take place. In parallel, Atefeh Tizchang will carry out lab-scale experimentation to verify optimised operation strategies.

Besides developing new technology, a second pillar of the research line focuses on conducting technology assessment in combination with research line TiE4 and beyond.

The Spanish State Research Agency (AEI) funds the INVEST project (2019-2022). The project (PRs Wolfgang Gernjak and Lluís Corominas) aims to establish a framework for making investment decisions that will support the implementation goals of the Water Framework Directive under different global change scenarios. Besides the PRs, Profs Ignasi Rodríguez-Roda (ICRA-UdG), Manel Poch (UdG) and Morgan Abily (ICRA, postdoctoral researcher) complete the core project team.

In 2020, the Catalan Water Agency funded the SUGGEREIX project executed at ICRA by Wolfgang Gernjak, Joaquim Comas, and Mercè Font, among others. The project is carried out in collaboration with EURECAT (coordinating institution), CETAQUA and the Catalan Water Partnership, and one of ICRA's responsibilities is to develop a decision support system to ensure the selection of appropriate treatment technology for the fit-for-purpose generation of reclaimed water. Knowledge acquired in this research line is also transferred to industry via consulting contracts and honorary roles, such as the participation

of Wolfgang Gernjak in the expert panel counselling ACA on water reclamation in the Prat de Llobregat WWTP.

Other activities in the research line include a strategic cooperation with the company s::can Messtechnik GmbH from Austria and its Spanish subsidiary s::can Iberia S.L. Within this line, Mireia Plà Castellana will be defending her PhD in 02/2023, in an Industrial Doctorate co-funded by the Generalitat of Catalonia to work on chemometric methods for enabling contaminant detection using optical spectroscopic sensors. Also, in October 2020, the COST Action 19110 PLAGRI project ("Plasma applications for smart and sustainable agriculture") commenced, in which Wolfgang Gernjak co-leads work group 4: "Plasma treatment of agricultural wastewater, growth media and production of plasma activated water"



T&A2. WASTEWATER TRANSPORT, TREATMENT AND MANAGEMENT

Research conducted under this line aims to improve current technologies and develop novel tools for treating wastewater in the context of the circular economy. The goal is not only to achieve the desired treatment standards but also to recover the valuable resources wastewater contains, such as energy, nutrients, and water.

This line aims to achieve better treatment performance in terms of macropollutants and contaminants of emerging concern, recover energy and nutrients and reduce the environmental impacts of treatment facilities. The experimental approach ranges from fundamental to applied research, with most of the projects involving strong participation from industry partners and water utilities.

Activities within this topic have been focused on the anaerobic treatment of different waste streams, targeting biogas recovery and conversion to valuable products. In this line, a new project funded by the Spanish State Research Agency through the call for Ecological and Digital Transition Projects and led by Dr Maite Pijuan and Dr Jose Luís Balcazar is exploring the bioconversion of methane into novel polymers. The project combines the operation of mixed culture bioreactors and pure culture systems, aiming to investigate the production of exopolymeric substances from biogas via different microbial communities and assess the suitability of the polymers produced to be used as bioplastics.

Also, research has continued to expand knowledge of pharmaceutical compound removal and/or biodegradation mechanisms. Within this line, the ANTARES project (PID2019-110346RB-C22), funded by the Spanish State Research Agency and led by Dr Jelena Radjenovic and Dr Maite Pijuan has continued during 2022. This project is coordinated by the Chemical Engineering Department at the University of Santiago de Compostela and investigates the fate and transformation of a wide range of micropollutants and antibiotic-resistance genes present in municipal wastewater under different treatment technologies. As part of the project, we are investigating the capabilities of a bio-reduced graphene oxide (GO) anaerobic system to remove certain micropollutants. The hypothesis being tested is that graphene oxide can be biologically reduced by anaerobic biomass acting as a redox mediator and facilitating the direct interspecies electron transfer process, thus enhancing the removal of several micropollutants that are resistant to biodegradation through conventional anaerobic processes. This is the topic of the PhD thesis being defended by Oriol Casabella, who obtained an FI PhD grant from Generalitat de Catalunya in March 2020. An anaerobic membrane bioreactor with sludge amended with graphene oxide has been in operation, and different conditions have been tested with regard to GO addition. Also, a set of batch tests were conducted to identify the effect of GO in terms of biogas production and micropollutant removal. Two scientific publications presenting the data obtained are under review.



T&A3. NEXT-GENERATION AND NATURE-BASED TECHNOLOGIES

The annual production of synthetic organic chemicals is estimated at 300 million tonnes, and a great majority of these reach water bodies and soils. Many of these chemicals are toxic and carcinogenic, have unexpected exposure pathways, and are persistent in currently employed water and wastewater treatment. Increased water scarcity is forcing us to contemplate alternative water supplies, such as greywater, harvested rainwater, reclaimed wastewater and others, imposing new paradigms in water and the introduction of decentralised (waste) water systems. The shift from the mainstream, linear, top-down model of urban water treatment towards a more circular model that prioritises (waste)water treatment as near as possible to the original source, is expected to promote local water reuse schemes for non-drinking purposes and thus reduce pressure upon the potable water supply. However, many technologies applied in large-scale wastewater treatment plants are not well-suited for smaller-scale units. There is a need to develop new technologies that offer robust, autonomous operation and are cost and energy-efficient at a smaller scale. Furthermore, many of the persistent organic contaminants, e.g., per- and polyfluoroalkyl substances (PFAS) and others, cannot be degraded using the currently applied advanced chemical oxidation methods.

Within the research line "Next-generation and nature-based technologies", we are focusing on developing new technologies and strategies for (waste)water treatment, mainly at a decentralised scale. Our main motivation is to develop technologies that are truly low-cost systems with minimum environmental footprint both in their construction and operation, which avoids the generation of polluted residual waste streams. To achieve a sustainable and cost-effective (waste) water treatment system, we are investigating the following technologies:

- nature-based solutions (NBS), and
- nanotechnology-enabled electrochemical treatment systems.

Regarding the first bloc of NBS, this line is expanding its activities within the HYDROUSA, CLEaN-TOUR, and ReUseMP3 projects in the context of Mediterranean areas and tourist installations and the COST action Circular City. Several activities are being conducted in collaboration with the water quality area (Sara Rodríguez-Mozaz) and/or the TiA4 line (Joaquim Comas).

The H2020 project HYDROUSA (2018-2023, Gianluigi Buttiglieri PR for ICRA), "Demonstration of water loops with innovative regenerative business models for the Mediterranean region", has been evaluating 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 agriculture purposes. The end goal is to establish the water-energy-food-employment nexus, creating jobs, boosting the economy, and making sure that the community and the stakeholders are engaged. Analytical protocols for analysing selected micropollutants have been upgraded in several water matrices and are being developed in crops (e.g., lettuce, oregano, lavender) within the framework of Marc Castañó's PhD thesis. Water, soil, and crop sampling campaigns took place in the Greek islands in the winter season (i.e., October-December 2021), with the results to be confirmed in the summer season (June-July 2022). Moreover, Dr Lúcia Helena Santos and Josephine Vosse are evaluating the human health risk related to the consumption of edible crops produced as part of the HYDROUSA activities.

The RETOS project CLEaN-TOUR (2018-2021, LRs Joaquim Comas, Gianluigi Buttiglieri), "Circular economy to facilitate urban water reuse in a touristic city: centralised or decentralised?" was being conducted within the framework of the PhD thesis of Esther Mendoza. The aim was to demonstrate the safety of regenerated water for irrigation and other uses, thus taking a step towards the circular economy in tourist regions. It analysed centralised systems and decentralised systems (segregating different types of water) to address: (i) the elimination of organic microcontaminants, (ii) the evaluation of possible risks associated with water reuse, and (iii) the difficulties in selecting the most suitable scenario (centralised or decentralised) with innovative treatment technologies, such as forward osmosis membranes and hydroponic technologies for greywater treatment with edible plants. A hydroponic pilot plant has been developed at ICRA's premises to test crops produced with greywater as well as plant uptake of organic micropollutants. In parallel, the feasibility of a vertical ecosystem for sustainable (grey)water treatment and reuse in tourist resorts was evaluated at different scales.

The AEI ReUseUseMP3 project (2021-2024, PIs Sara Rodriguez-Mozaz, Gianluigi Buttiglieri), "Integrating nature-based water reuse strategies with advanced monitoring of the presence and impact of microPollutants and microPlastics" (PID2020-115456RB-I00) has recently started. The PhD thesis of Josephine Vosse will be developed within the framework of ReUseMP3.

It aims to explore the feasibility of using NBS with direct reuse purposes – including the irrigation of crops for food production in cities in a more sustainable way. A range of analytical methodologies, including target analysis of known emerging pollutants but also a wide-scope suspect and non-target analysis, are being applied to provide a better overview of the presence and removal of substances of emerging concern along the water reuse cycle as well as their impact on the environment and human health. Microplastics and their additives will also be monitored in these studies, which include lab-scale experiments under controlled conditions with real grey/wastewater, as well as field studies (e.g., Hotel Samba in Lloret de Mar; Girona urban gardens; Lesbos Island in Greece). All the data collected during the project will also allow the development of innovative decision-support tools for water management.

Also of note is ICRA's involvement in the Circular City (Implementing NBS for creating a resourceful circular city) COST action (2018-2022) with Gianluigi Buttiglieri as MC for Spain and other ICRA researchers involved (e.g., Joaquim Comas, Joana Castellar). In this context, several reviews and research articles (co-authored by several international experts in NBS) have been written to provide a cross-sectoral view on using NBS to enable and manage circular cities and urban waters and how to close these water cycles in the built environment through NBS, with a focus on the contribution of vertical greening systems and green roofs.

Another related research topic deals with organic micropollutants (pharmaceutical, endocrine disrupting compounds, and watch-list compounds) to expand knowledge of their removal and/or biodegradation mechanisms. Additional studies were performed in collaboration with the water quality area to evaluate combining biological processes (activated sludge or fungi) with UV/H₂O₂ to remove pharmaceutically active compounds (and detailed studies on metoprolol and metoprolol acid) from real hospital wastewater. Finally, the mechanisms in microalgae were studied (*Chlorella vulgaris* and mixed algal-bacterial cultures) for their potential to remove contaminants of emerging concern in collaboration with Ljubljana University and the Jožef Stefan Institute, leading to the 2021 University of Ljubljana Best Research Achievement prize.

Regarding the second block of nanotechnology-enabled electrochemical treatment systems, electrochemical systems have several intrinsic advantages that make them ideal technologies for smaller-scale decentralised treatment of contaminated water. They do not use chemical reagents – only electrons, thus avoiding the costs associated with the production, transport, storage and handling of chemicals; they do not form a residual waste stream, and they operate at ambient temperature and pressure. Furthermore, electrochemical systems have a small footprint and modular design, making them easy to combine with other technologies (e.g., adsorption, ion exchange) in hybrid (waste)water treatment units. Electrochemical systems are considered highly robust, easily adaptable to changes in the influent wastewater composition and/or volume, and capable of degrading even the most persistent contaminants, such as PFAS.

Nevertheless, electrochemical (waste)water treatment systems are rarely applied at a wider scale due to the major limitations of the existing electrode materials (i.e., boron-doped diamond (BDD), mixed metal oxide (MMO)): (i) high energy consumption, due to the low surface area of the pricey commercial electrodes, and (ii) rapid oxidation of Cl⁻ ions to free chlorine, chlorate (ClO₃⁻) and perchlorate (ClO₄⁻). Research conducted at ICRA has managed to overcome both limitations by developing low-cost graphene sponge electrodes, in the scope of the ERC Starting Grant (StG) ELECTRON4WATER. Graphene sponge electrodes present several key advantages compared to commercial anode materials, mainly due to their high electrochemical inertness to chloride. Even when polarised at high anodic current densities and in brackish water, graphene sponge electrodes do not form ClO₃⁻ or ClO₄⁻ and display very low current efficiency for chlorine formation (<0.1%), thus also minimising the amount of the formed organochlorine by-products. At the same time, graphene sponge electrodes form in situ strong oxidants such as hydroxyl radicals (•OH), ozone (O₃), and hydrogen peroxide (H₂O₂), which can degrade a range of organic pollutants (e.g., pesticides, antibiotics and personal care products). Most remarkably, the graphene sponge anode is capable of C-F bond cleavage and electrochemical defluorination of persistent PFAS. These achievements effectively enable the electrochemical treatment of brackish, PFAS-rich waste streams (e.g., reverse osmosis brine, landfill leachate), which was not possible previously without an enormous increase in toxicity, owing to the formation of chlorinated by-products on commercial anodes such as BDD. Furthermore, the nature of the graphene coating with its high amenability to functionalisation and insertion of dopants, two-dimensional materials and others, opens up the possibility of tailoring these

materials to remove and degrade specific pollutants. Resorting to nanotechnology can thus enable the degradation of even the most persistent pollutants, such as PFAS, without using expensive noble metal catalysts. This work is currently being protected in the PCT international patent application (PCT/EP2021/076930).

Another nanostructured material developed within the ERC StG ELECTRON4WATER is TiO₂ nanotube array (NTA)-based material coated with different manganese and manganese/molybdenum oxides. This material has been successfully used for the selective electrochemical oxidation of sulphide to sulphur, which has implications not only for sulphide removal from wastewater but also for treating other concentrated sulphide streams (e.g., scrubbing solutions from biogas treatment). In addition, an electrochemical system equipped with an Mn-oxide-based TiO₂ NTA electrode costs up to five times less than commercial mixed metal oxide-based anodes. We are currently exploiting other uses for this system, e.g., removing toxic arsenic from groundwater and removing other organic contaminants. The invention is now being processed in a European patent application (21-0584-EP).

The ELECTRON4WATER team working on the nanotechnology-enabled electrochemical treatment systems currently has two postdoctoral research fellows, Dr Elisabeth Cuervo Lumbaque and Dr Natalia Sergienko, and three PhD students: Natalia Ormeño Cano, Nick Duinslaeger and Anna Segues Codina. Dr Natalia Sergienko successfully defended her PhD thesis in October 2021 ("Electrochemical control and minimisation of hydrogen sulphide formation in anaerobic systems"), under the supervision of Dr Jelena Radjenovic and Dr Oriol Gutierrez, and was awarded a cum laude distinction by the University of Girona.

Besides electrochemical systems, the potential of nanotechnology to advance other wastewater treatment technologies has also been investigated within the Marie Curie International Training Network (MC ITN) project NOWELTIES, coordinated by Dr Mira Petrovic. PhD student Michele Ponzelli is currently conducting his thesis on the role and impact of graphene oxide on the anaerobic biotransformation of organic pollutants and biogas production. Another project funded by the Spanish Ministry of Science and Innovation, ANTARES, led by Dr Jelena Radjenovic and Dr Maite Pijuan, is also being conducted in the same field – graphene-enabled anaerobic wastewater treatment. Details about this project have been provided in the previous research line.

In the context of the previously mentioned NOWELTIES project, another PhD student, Danilo Bertagna, is currently conducting his thesis on photolysis and photocatalysis in water with UVA-LED. He first evaluated the state-of-the-art and current challenges for TiO₂/UV-LED photocatalytic degradation of emerging organic micropollutants, and then he studied the impact of UV-LED photoreactor design on their degradation. He considered five contaminants of emerging concern, evaluating the performance under different initial conditions. The design of experiments (evaluating the influence of bicarbonates, nitrates, and humic acids in aqueous solutions during photocatalysis) showed the different reactions to matrix alterations. Process optimisation will depend on the analysis of each case-scenario, the reactivity of each target pollutant, and the final effluent's quality requirements.

Finally, the LIFE project RECYCLO (PRs Sara Rodriguez-Mozaz, Gianluigi Buttiglieri), "RECYCLing wastewater from small and medium-sized laundries with advanced Oxidation process", aims to improve water resource efficiency and reduce pollutant discharge by providing an innovative recycling process for small and medium-sized laundries. A new technology, based on advanced oxidation processes (AOP) for water reuse is being proposed by the consortium, with a promising capacity to degrade emerging pollutants. The three laundries involved as partners (in Spain, France, and Luxemburg) will become a showcase for the textile sector by demonstrating that the system works for different sizes and different wastewater qualities. ICRA will develop the monitoring protocol and adapt analytical methods for emerging pollutants in laundry wastewater, including pharmaceuticals, antimicrobials, preservatives, flame retardants, plasticisers, and other plastic additives. The effluents of the three laundries will thus be characterised, and the concentrations of emerging pollutants will be determined throughout the different treatment settings in the selected laundries.

T&A4. MODELLING, ASSESSMENT AND DECISION-SUPPORT FOR URBAN WATER SUSTAINABILITY AND RESILIENCE

The main focus of research line TiA4 is on developing tools and methodologies to support urban water system (UWS) management. Line TiA4 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:

- Digitalisation of the water sector
- Planning of sustainable cities including Nature-Based Solutions
- Integrated management of urban wastewater systems

Ongoing projects with contributions from this research line during 2022 and 2023 are SCOREwater, EdiCitNet, 4SM, CityPoll, SARSAIGUA, GiroNat and MULTISOURCE. INVEST, DWC and SUGGEREIX finished in 2022.

Digitalisation of the water sector

The H2020 SCOREwater project continued during 2022. Led by Dr Corominas and together with BCASA, s::can iberia, IERMB and Eurecat, we monitored chemical and physicochemical variables in 3 neighbourhoods of Barcelona with different socio-economic statuses for one year. Ian Zammit and Sergi Badia carried out the sampling and lab work for the chemical and microbiological analysis of the sewage samples. The results were analysed in tandem with health data during 2022.

Dr Corominas and Dr Collado from TiA 4 are part of the coordination team (completed with Dr Laura Guerrero and Dr Carles Borrego from the Quality Area) for the wastewater-based surveillance system for SARS-CoV-2 in Catalonia (sarsaigua.icra.cat). The network successfully monitored the circulation of the virus and demonstrated a significant correlation with diagnosed cases. Funding has been secured from the Catalan Government for 2022 and 2023.

The H2020 project "Digital water.city: Leading Urban Water Management to its Digital Future" (DWC) (<https://www.digital-water.city/>) was officially finalised in November 2022. Despite the enormous logistical challenges faced at the very beginning of the project due to the covid restrictions, the project has been a

success, with many activities accomplished and new challenges and partners for the future. The solutions developed within DWC were tested in the sewer networks of Berlin, Sofia and Milan, and the water authorities of those metropolises now have updated information about the behaviour of their sewer overflow structures that will allow them to take the appropriate controlling measures. We learned so many things and look forward to further developing and implementing ICRA' SENVES+ solution for reducing the cost of CSO monitoring.

Dr Corominas and Dr Comas are promoters of the Information Technologies (IT) lab at ICRA (itlab.icra.cat). ICRA collects all the IT products to come out of research projects. Each product has a description, and the link to the source code is provided to foster its usage by the research community (whenever the license allows for it). A list of these products can be found in the Technology transfer section.

In collaboration with ICRA's Resources & Ecosystems and Water Quality areas, we also started the project CityPoll: City run-off pollution impacts river biodiversity under extreme climatic events. Funded by «Ecological and Digital Transition Projects» under the EU Next-Generation scheme, CityPoll aims to establish the impacts of urban effluents occurring in storm events on river biodiversity, as well as their potential effects on the main ecosystem functions. Our specific tasks within the project will be to develop centralised digitalisation schemes and optimised chemical monitoring of urban settlements in order to evaluate the impact of extreme rainfall events on river biodiversity.

Planning of sustainable cities, including nature-based solutions

In 2022, TiA4, in collaboration with the Resources and Ecosystems Area, has intensified its work on the H2020 project EdiCitNet (<http://www.edicitnet.com>), which aims to foster the systemic use of nature-based solutions for food production as a major step towards more sustainable, liveable and healthier cities. During 202, ICRA researchers (Dr Castellar, Dr Pueyo, Dr Acuña, Dr Corominas and Dr Comas) have led the development of the joint platform, which will integrate all tools and services developed within the project (interactive catalogue, design and planning, performance assessment, and educational game supported by a database) to support public and private stakeholders in NBS learning and implementation (<https://toolbox.edicitnet.com/>). Furthermore, in

2022, the first prototype for the Edible City Game, a serious game for participatory urban planning and scenario simulation of ECS benefits, was tested with Sant Feliu de Llobregat in Catalonia and Sempeter pri Gorici in Slovenia. The game will also be tested for educational purposes with high school students. The game aspires to provide a valuable contribution to designing the transition to more edible cities. This year, we have continued our contact with NBS-sister projects to look for synergies and amplify the project's impact, also with the EU NBS taskforces.

The EU MULTISOURCE project (multisource.eu) started in June 2021. The aim is (i) to demonstrate a variety of innovative NBS treating a wide range of urban waters, and (ii) to develop innovative tools, methods, and business models that support citywide planning and long-term operations and maintenance of NBS for water treatment, storage, and reuse in urban areas worldwide. In 2022, CRA has been (i) leading the development of the Technology selection & design tool concept, a web-based decision-support tool for stakeholders to facilitate the selection and design of NBS for water treatment, and (ii) coordinating the Girona pilot based on a hybrid green wall to treat greywater, together with the Municipality of Girona. The technology selection & design tool is based on the existing <http://snapp.icra.cat> tool, but further develops the co-benefits of economic and environmental impact assessment. This project is led by Joaquim Comas with participation from Lluís Corominas, Gigi Buttiglieri, Joana Castellar and Josep Pueyo, as well as Vicenç Acuña (from RiE) and Sara Rodríguez-Mozaz (from Qual).

At the end of 2022, the GiroNat project, funded by NextGenerationEU funds and coordinated by the Municipality of Girona, started. The aim is to promote Girona's ecological transition towards becoming a more resilient and healthier city. This project is led by Lluís Corominas and Josep Pueyo, with participation from Joaquim Comas, Rubén Oncala and Silvia Busquets. ICRA is in charge of developing a hydraulic and hydrological model of the city to simulate the city hotspots related to rainfall run-off and combined sewer overflows and evaluate the impact of sustainable urban drainage systems and other NBS for water management (e.g. greenwall for greywater treatment).

Integrated management of urban wastewater systems

In the INVEST project, research professor Wolfgang Gernjak and research scientist Lluís Corominas are attempting to establish a framework that can be used to make investment decisions that contribute to achieving the implementation of the Water Framework Directive goals under different global change scenarios. Prof. Ignasi Rodríguez-Roda (ICRA-UdG), Manel Poch (UdG) and Morgan Abily (ICRA, postdoctoral researcher)

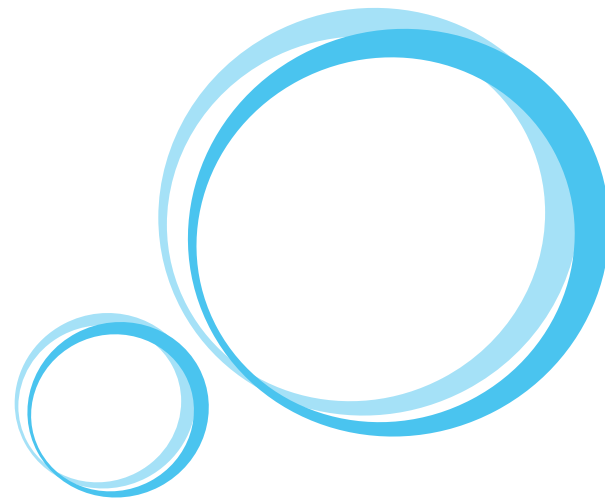
complete the core project team. In 2022, we finalised strategic roadmaps for the selection of tertiary water treatment technologies based on the interpretation for the EU of the Shared Socioeconomic Pathways (SSPs) global change narratives, and we have finalised the integrated model for sanitation and river networks in Europe, which is used for evaluating the implementation of tertiary treatment under different climate change scenarios.

In 2022, the first prototype of the SUGGEREIX decision-support tool to support the selection of the most adequate advanced water reclamation scheme (for different water reuse purposes) was finished. The tool also enables a multi-criteria analysis of the most viable alternatives, recommends a monitoring plan and provides similar successful cases. The working team for this project includes David Martínez, Lluís Bosch, Wolfgang Gernjak, Mercè Font, Lluís Corominas, Gianluigi Buttiglieri and Joaquim Comas.

Also related to water reuse, the development of the decision-support tool to support the planning of reclaimed water networks for water reuse in cities, including the collection of wastewater or greywater, its treatment, and the (re)distribution of the reclaimed water has continued within the ReUseMP3 project (explained in research line III.3). This DSS supports the generation and assessment of the most adequate water reuse for decentralised (or centralised) scenarios. Output data include the optimal water reuse network, as well as the change between current and future (water reuse) scenarios in terms of the number of inhabitants served, the nexus flows (drinking water savings and energy footprint) and the construction. The tool has been tested and validated for the generation of reclaimed water networks for the cities of Girona and Lloret de Mar. The tool's functionalities will be expanded with the assessment of decentralised scenarios and risks in water reuse and the operation and maintenance costs. The tool is being developed in collaboration with the computer science research group BCDS (Broadband Communications and Distributed Systems) at the UdG. Josep Pueyo, Gianluigi Buttiglieri, Lluís Corominas and Joaquim Comas (from ICRA) and David Martínez and Eusebi Calle (from UdG) form the interdisciplinary team working on this tool.

In 2022, TiA continued working on the development of an educational game in cooperation with GILAB (University of Girona). Dr Corominas led the development of an educational game to educate primary school students about the urban water cycle (from the tap to freshwater ecosystems) in collaboration with GILAB (University of Girona). The educational game has been expanded to incorporate new scenarios under the umbrella of the SCOREwater project. In 2022, Dr Corominas and Dr Xavier Garcia-Acosta held sessions at 4 schools (more than 120 children) using the serious game to raise public awareness of the urban water system.

2022 was the first year of the 4SM Spread Sewer Sensing for Sustainable Management project, in which we aim to create a new set of sensors and tools for the advanced and sustainable management of sewer systems. The 4SM team was joined by Sílvia Busquets, Nicole Aguiar and Sergi Bergillos, who worked on the smart digitalisation of sewer systems by developing new data platforms and deploying advanced monitoring tools in wastewater transport systems. The first results are on the way with promising new technologies specially designed to perform and survive in harsh sewer conditions



TECHNOLOGY TRANSFER

The products to come out of the ICRA itlab (itlab.icra.cat) are listed below:

- **SARSAIGUA.** A web-based tool to disseminate the results of the circulation of SARSCoV-2 in Catalonia through the analysis of wastewater; 18,000 users since its launch in Nov. 2020 and 40,000 visits. Principal Investigators: Carles Borrego and Lluís Corominas.
- **ECAM.** The "Water and Wastewater Companies for Climate Mitigation" (WaCClIM) is a joint initiative between GIZ (Germany) and the International Water Association (IWA). >100 water utility companies are using ECAM (more than 50% in developing countries), and it has helped them reduce greenhouse gas emissions by 20% on average. ECAM is being promoted by the United Nations Framework Convention on Climate Change (UNFCCC.int). Principal Investigator: Lluís Corominas.
- **SNAPP.** Science for Nature and People Partnership. Funded by The Nature Conservancy, Wildlife Conservation Society and NCEAS (US). A web-based tool to promote the usage of nature-based solutions for water sanitation. Launched in March 2022. Principal Investigators: Vicenç Acuña, Lluís Corominas and Joaquim Comas.
- **EdicitNet toolbox.** A social network for connecting activities for sustainable food production, transformation and distribution at a city level. It has registered 105 users and 190 edible city solutions since it was launched in Feb 2021. Principal Investigators: Joaquim Comas and Josep Pueyo.
- **Ecoadvisor for wise leading water management.** Funded by the "Aigües de Catalunya" water utility company. A web-based tool designed to help water utility companies and water authorities manage urban water infrastructure and rivers in an integrated manner. Ecoadvisor offers "Aigües de Catalunya" an advantage in tenders for the management of sewer systems. Aigües de Catalunya is part of Global Omnium, a leading national and international business group with more than 125 years of history, technologically leading, serving more

than 300 municipalities and more than six million people, with a presence in Europe, Africa, Asia and Latin America. Principal Investigators: Lluís Corominas, Joaquim Comas and Vicenç Acuña.

- **SENVES+.** A device to monitor the frequency and duration of combined sewer overflows in wastewater networks; its origin comes from the patent described in the previous section, and it is currently being converted into a commercial product within the DWC H2020 project. In 2021, SENVES+ was tested in Berlin and Sofia, and implementation had just begun in Milan. During this time, technological advancement focused on increasing data transfer using low-consumption methods and improving accuracy to avoid false-positive overflow detection, one of the main concerns of water utility companies in charge of storm-wastewater management. Principal Investigators: Lluís Corominas and Oriol Gutierrez.
- **RedCross HWT-DSS.** Provides decision support when choosing technologies to treat drinking water at a household level in emergency situations. Principal Investigators: Ignasi Rodríguez-Roda and Raquel García-Pacheco (Ecomemb).
- **ReWat DSS.** Decision-support tool to support the planning of reclaimed water networks for water reuse in cities, including the collection of wastewater or greywater, its treatment and the (re)distribution of the reclaimed water.. IP: Joaquim Comas and Lluís Corominas.
- **SAD SUGGEREIX.** Provides decision support when choosing technologies for advanced (tertiary) wastewater treatment for different water reuse purposes. Principal Investigators: Joaquim Comas and Wolfgang Gernjak.

AIII - PHD DISSERTATIONS

Danilo Bertagna Silva, UV-LED advanced oxidation processes for the efficient removal of organic macropollutants from water. Supervisors: S. Babic (FKIT, Zagreb, Croatia), G. Buttiglieri. July, 2022.

AIII - VISITING STUDENTS

Assabri, Mohamed - University of Girona (Udg)
Doni, Ariadni - Aristotle University of Thessaloniki
El Houda Slama, Nour - Monastir Faculty of Science
Gamoura, Mohamed - University Bordj Bou Arreridj
Guillaume, Sophie - INRAE
Ioan, Michelle Danielle - University of Girona (Udg)
Morovic, Silvia - University of Zagreb
Papapanou, Ioanna Melina - University of Patras
Riva, Massimiliano - I Università degli Studi dell'Insubria
Tan, Tian - Universite Cote Azur
Toribio Giral, Sergi - University of Girona (Udg)
Valls Conesa, Oriol - University of Girona (Udg)
Vert Coll, Eduard - University of Girona (Udg)
Vila Duran, Pol - University of Girona (Udg)
Kumar, Amit - Institute of Physics Belgrade
Sanchez Tobon, Camilo - University of Zagreb
Bertagna Silva, Danilo - University of Zagreb

AIII - STAYS ABROAD

Jelena Radjenovic, UC Berkeley, Berkeley Water Centre, 01/05-01/08/2022



A photograph of a male scientist with dark, curly hair, wearing a white lab coat, safety glasses, and blue nitrile gloves. He is seated at a biosafety cabinet, holding a black and yellow pipette. The biosafety cabinet has a glass front and contains various laboratory equipment, including a rack of pipettes, a blue thermal cycler, and several yellow and white containers. The background is a plain white wall. A decorative blue curved line runs across the top of the image.

05

Publications and congresses

SCI PUBLICATIONS (SCIENCE CITATION INDEX 2022) : 141

(Publications ordered alphabetically)

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Zheng X., Jahn M.T., Sun M., Friman V.-P., Balcasar J.L., Wang J., Shi Y., Gong X., Hu F., Zhu Y.-G. (2022), **“Organochlorine contamination enriches virus-encoded metabolism and pesticide degradation associated auxiliary genes in soil microbiomes”** ISME Journal, vol. 16, no. 5, pp. 1397-1408. IF= 10.302, Q1

BOOKS

BOOK CHAPTERS (12)

Abily, M., Acuña, V., Gernjak, W., Rodríguez-Roda, I., Poch-Espallargas, M. & Corominas, L. 2022, **Assessment of Spanish Rivers Current and Future Ecological Status Using Urban Wastewater Dilution Factor**. DOI: 10.1007/978-981-19-1600-7_69

Bertrand, N., Abily, M., Lambert, M. & Delestre, O. 2022, **Benefit of Coupling 1D-2D Model Over an Urban Area to Assess Runoff During a Storm Event**. DOI: 10.1007/978-981-19-1600-7_20

Byrne, D.M., Roux, P. & Corominas, L. 2022, **“Environmental assessment of urban water systems: LCA case studies”** in Assessing Progress Towards Sustainability: Frameworks, Tools and Case Studies, pp. 327-345. DOI: 10.1016/B978-0-323-85851-9.00017-1

Flores-Alsina, X., Arnell, M., Corominas, L., Sweetapple, C., Fu, G., Butler, D., Vanrolleghem, P.A., Gernaey, K.V. & Jeppsson, U. 2022, **“Benchmarking strategies to control GHG production and emissions”** in Quantification and Modelling of Fugitive Greenhouse Gas Emissions from Urban Water Systems: A report from the IWA Task Group on GHG, pp. 213-228. DOI: 10.2166/9781789060461_213

Gutierrez, O., Duan, H., Wu, Z. & Sharma, K.R. 2022, **“Mechanisms, source, and factors that affect methane emissions”** in Quantification and Modelling of Fugitive Greenhouse Gas Emissions from Urban Water Systems: A report from the IWA Task Group on GHG, pp. 43-62. DOI: 10.2166/9781789060461_043

Hayes, D.S., Schülting, L., Carolli, M., Greimel, F., Batalla, R.J., Casas-Mulet, R. (2022): **Hydropeaking: processes, effects, and mitigation**. Encyclopedia of Inland Waters, Reference Module in Earth Systems and Environmental Sciences, Elsevier, Vol. 2, 16 pp., ISBN 9780124095489, <https://doi.org/10.1016/B978-0-12-819166-8.00171-7>.

Parravicini, V., Filali, A., Delre, A., Gutierrez, O. & Duan, H. 2022, **“Full-scale quantification of Ninf2/infO and CHinf4/inf emissions from urban water systems”** in Quantification and Modelling of Fugitive Greenhouse Gas Emissions from Urban Water Systems: A report from the IWA Task Group on GHG, pp. 91-131. DOI: 10.2166/9781789060461_91

Pereira, P., Kalinauskas, M., Das, M., Bogdzevič, K., Inácio, M. & Barcelo, D. 2022, **Mapping and assessment of flood regulation supply and demand in Vilnius (Lithuania)**. 10.1016/bs.apmp.2022.10.015

Pijuan, M. & Zhao, Y. 2022, **“Full-scale source, mechanisms and factors affecting nitrous oxide emissions”** in Quantification and Modelling of Fugitive Greenhouse Gas Emissions from Urban Water Systems: A report from the IWA Task Group on GHG, pp. 11-41. DOI: 10.2166/9781789060461_011

Santos, L.H.M.L.M., Rodríguez-Mozaz, S., Barcelo, D. "Sorption of Pharmaceuticals on Microplastics (2022)". Handbook of Microplastics in the Environment: With 157 Figures and 91 Tables, pp. 577-612. DOI: 10.1007/978-3-030-39041-9_14

Sharma, K., Gutierrez, O., Yuan, Z., Daelman, M.R.J., van Loosdrecht, M.C.M. & Volcke, E.I.P. 2022, "Modelling of methane production and emissions" in Quantification and Modelling of Fugitive Greenhouse Gas Emissions from Urban Water Systems: A report from the IWA Task Group on GHG, pp. 197-212. DOI: 10.2166/9781789060461_197

Vasilaki, V., Pijuan, M., Duan, H. & Katsou, E. 2022, "Full-scale emission results (Ninf2/info and CHinf4/inf)" in Quantification and Modelling of Fugitive Greenhouse Gas Emissions from Urban Water Systems: A report from the IWA Task Group on GHG, pp. 133-166. DOI: 10.2166/9781789060461_133

Balcázar, J.L. Editorial board member, Annals of Microbiology (BMC).

M. Pijuan, Associate Editor from Water Research

M. Pijuan, Associate Editor from Case Studies in Chemical and Environmental Engineering

J. Radjenovic, Associate Editor of Journal of Hazardous Materials (ranked 4th in Environmental Engineering field), and Editor of Journal of Hazardous Materials Letters (new journal by Elsevier).

G. Buttiglieri, guest editor of the International Journal of Environmental Research and Public Health (IJERPH) Special Issue "COVID-19: Wastewater-Based Epidemiology".

W.Gernjak, editor from Water Research Reports



EDITORIAL BOARDS OF BOOKS AND SCIENTIFIC JOURNALS

Batalla, R.J. - Member of the Editorial Board Zeitschrift für Geomorphologie

Batalla, R.J. - Associate Editor of Water

Marcé, R. - Scientific Advisor for the Biogeochemical Cycles Collection of Open Research Europe

Mas-Pla, J. - Associate Editor of Hydrogeology Journal (Springer, Q1)

Mas-Pla, J. - Associate Editor of Antibiotics, Section Board for 'Antibiotics Use and Antimicrobial Stewardship' (MDPI, Q1)

Mas-Pla, J. - Associate editor of Water (MDPI, Q2).

Sabater, S. - Editorial Board Member and Associate Editor of The Science of the Total Environment (Elsevier)

Sabater, S. - Editorial Board Member of Acta Biológica Colombiana

Sabater, S. - Associate Editor of Freshwater Science (specialty section of Frontiers in Environmental Science).

Petrovic, M., Editor-in-Chief, Trends in Environmental Analytical Chemistry (Elsevier), impact factor 13,622 (no. 2 in Analytical Chemistry)

Farré, M.J. Advisory board member of the Journal Environmental Science: Water Research & Technology.

Balcázar, J.L. Editorial board member, Environmental Science and Pollution Research (Springer).

Balcázar, J.L. Editorial board member, Journal of Applied in Microbiology (Wiley).

PRESENTATIONS AT CONGRESSES

ORAL PRESENTATIONS (24)

Barceló D. 11th European Conference on Pesticides and Related Organic Micropollutants in the Environment. Title: Removal technologies for emerging contaminants in water. Ioannina, Grecia. June 2022.

Barceló D. 15th International symposium on the interactions between sediments and water. Title: Fate, Risks and Remediation of Emerging Contaminants, Antibiotic Resistance Genes and Microplastics in Surface Waters and Groundwaters of Selected European Rivers and Future Covid-19 Related Challenges. Piran, Slovenia. June 2022.

Barceló D. 5th MS Day of the Mass Spectrometry Division of the Italian Chemical Society (ICS). Title: Wastewater-based epidemiology to monitor Covid-19 outbreak: Present and Future Diagnostic Methods to Identify Large Molecules Using Environmental Proteomics. Milano, Italy. November 2022.

Barceló D. Ciclo de Conferencias- Residencia de Investigadores del CSIC. Title: Cambio Global y Agua. Barcelona, Spain. April 2022.

Barceló D. IMPACT. INNOVATIVE MONITORING TO PRIORITISE CONTAMINANTS OF EMERGING CONCERN. Title: Mass Spectrometry in Wastewater-Based Epidemiology (WBE) for the determination of small and large molecules as biomarkers of exposure: Needs for Covid-19 testing with environmental proteomics (EP-WBE). DCU-Dublin City University-Virtual. May 2022.

Barceló D. IWA-DIPCON 2022. Title: Fate and Removal of Pharmaceuticals and New Threats ,i.e. Microplastics in European Rivers under Water Scarcity and Global Change: The EU Globaqua Project and beyond. Istanbul, Turkey. October 2022.

Barceló D. 2022. 2nd European Sample Preparation e-Conference and 1st Green and Sustainable Analytical Chemistry e-Conference. Title: Optimization and green metrics analysis on the microplastics determination in water and sediments. March 2022.

Barceló D. Agua para el bien común: incidencia, investigación y retos-Gobierno de Mexico y Conacyt. Title: MACRO-PALSTICS IN THE AQUATIC ENVIRONMENT: GREEN ANALYTICAL PROTOCOLS, RISKS AND SUSTAINABLE SOLUTIONS. Chihuahua, Mexico- Virtual. October 2022.

Barceló D. INTERNATIONAL EXHIBITION & FORUM ON AFFORESTATION TECHNOLOGIES. Title: Afforestation as nature-based solution to reduce heatwaves and floods. Riyadh, Arabia Saudi. May 2022.

Barceló D. Nanofiltration 2022. Title: The EU GLOBAQUA project on multiple stressors in rivers under water scarcity and global change. Results of a reconnaissance study in selected European rivers and the need for advanced water treatment solutions. Achalm, Reutlingen, Germany. June 2022

Barceló D. Pittcon 2022-VIRTUAL via ZOOM. Title: Analysis of Microplastics in Water. Atlanta, GA, USA. March 2022.

Barceló D. Princess Nourah University invited lectures. Title: How to write an Excellent Paper to be Published in High Impact Journals. May, 2022.

Barceló D. University of Aveiro, Palestras DO. Title: Microplastics in the aquatic environment: Green analytical chemistry protocols, risks and solutions. Aveiro, Portugal. July 2022.

Batalla, R.J. - IAHR World Congress, 2022 From Snow to Sea, Granada, Spain; Advisory Board, June 2022.

Barceló D. King Saud University invited lectures. Title: Macro-and micro-plastic litter and increased covid-19 based plastic pollution in waters: environmental risks and threat to biodiversity. Riyadh, Arabia Saudi. February 2022.

Farré M.J. ISGlobal. Conference on the Aigua BCN Project. Exposure to emerging contaminants in drinking water in Barcelona, January 2022. Barcelona, Spain. Trihalomethanes, haloacetonitriles and non-targeted DBPs in drinking water samples.

Farré M.J. IWA seminar organized by IWA Specialist Group (SG) of Disinfection "The future of disinfection in drinking water & wastewater". 9 Nov, 2022. Online

Comas J. Decision Support System for the assessment of water reuse schemes. Keynote invitada al Second International Symposium on Nanomaterials and Membrane Science for Water, Energy and Environment, Desalination and Reuse in the face of water scarcity. Juny 2022.

Mas-Pla, J. Reflections on the presence of antibiotics in groundwater and their incidence on health. Cycle: Contribution of Geology to the problems of Society 2022. University of Alicante, 18 October 2022.

Petrovic, M., Inaugural guest lecture, Analysis of organic micropollutants in environmental samples. Taking advantage of the latest advances in LC-HRMS, XVII Meeting of the Andalusian Regional Group of the Spanish Society of Analytical Chemistry (GRASEQA 2022). 6-7 Oct, 2022, Seville, Spain.

Petrovic, M., Pharmaceutical residues in the aquatic environment Challenges and opportunities of using advanced analytical methods for their monitoring, 9th BBBB International Conference on Pharmaceutical Sciences. Dec 14-16, 2022, Ljubljana, Slovenia.

Radjenovic J. 2022. Emerging nanostructured materials for electrochemical water treatment. Invited talk at Summer@UIC Seminar series, University of Illinois at Chicago.

Radjenovic J. 2022. Nanotechnology-enabled water and wastewater treatment strategies: main achievements of the ERC Starting Grant ELECTRON4WATER. Keynote at the 10th Conference of the UK Water Network. Cranfield University, UK

Rodríguez-Mozaz, S. Seminars series for secondary teacher training and update. "Emerging pollutants in the environment. The case of pharmaceutical compounds in water". Dec 16, 2022. Girona, Spain

PATENTS/PILOT PLANTS

Spanish Patent: ES2490065

Title: System for monitoring overflows in pipe networks

Application date: 27/02/2013 - Grant date: 09/06/2015

Holder: Catalan Institute for Water Research Foundation (ICRA)

Inventors: Oriol Gutiérrez García-Moreno; Lluís Corominas Tabares; Vicenç Acuña Salazar

European patent application: EP21382385

Title: Method to prepare an electrode with a manganese oxide coated titanium oxide nanotube array interlayer, electrode obtained thereof, and uses of the electrode

Application date: 30/04/2021

Holder: Catalan Institute for Water Research (ICRA) and Catalan Institution for Research and Advanced Studies (ICREA)

Inventors: Natalia Sergienko and Jelena Radjenovic (ICRA-ICREA)

European patent application: EP20382879

Patent Cooperation Treaty (PCT) application: PCT/EP2021/076930

Title: Method to prepare graphene coated sponges, sponges obtained thereof, electrodes obtained from such sponges and uses of the sponges for water treatment

Application date: 02/10/2020 (EP), 30/09/2021 (PCT)

Holder: Catalan Institute for Water Research (ICRA) and Catalan Institution for Research and Advanced Studies (ICREA)

Inventors: Lluís Pires, Nick Diuslaeger, Florjan Norra and Jelena Radjenovic (ICRA-ICREA)

European patent application: EP20382065

Patent Cooperation Treaty (PCT) application: PCT/EP2021/052228

Title: Rend-cap device. Self-assembling membrane housing for low pressure water filtering application

Application date: 31/01/2020 (EP) - 31/01/2021 (PCT)

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

Inventors: Raquel García Pacheco (UdG) and Joaquim Comas Matas (UdG-ICRA)





06 Projects

RESOURCES AND ECOSYSTEMS RESEARCH
AREA

WATER QUALITY AND SAFETY RESEARCH
AREA

TECHNOLOGIES AND ASSESSMENT

RESOURCES AND ECOSYSTEMS RESEARCH AREA

PROJECT	
GW-GEN: Antibióticos, genes de resistencia y riesgos asociados en el agua subterránea	
Funding agency:	Agencia Estatal de Investigación (AEI) y financiado por la Unión Europea NextGeneration EU/ PRTR
Duration:	2020-2023
Coordination:	ICRA
Leader researcher:	Mas Pla, Josep
Amount for ICRA:	€10,000

PROJECT	
DRYvER - Securing biodiversity, functional integrity and ecosystem services in DRYing rivER networks	
Funding agency:	EUROPEAN COMMISSION
Duration:	2020-2024
Coordination:	Institut National de recherche pour l'agriculture, l'alimentation et l'environnement (Inrae) FR
Leader researcher:	Sergi Sabater
Amount for ICRA:	€136,541.25

PROJECT	
Multiple stressors impacting rivers: community and ecosystem function (RIVSTRESS)	
Funding agency:	Agencia Estatal de Investigación (AEI)
Duration:	2021-2024
Coordination:	University of Barcelona
Leader researcher:	Sergi Sabater
Amount for ICRA:	€151,250

PROJECT	
Transporte de contaminantes emergentes en agua subterránea bajo condiciones de remediación IN-SITU (TED2021_EMFASIS)	
Funding agency:	Agencia Estatal de Investigación (AEI), Mecanismo para la Recuperación y la Resiliencia (MRR)
Duration:	2022-2024
Coordination:	University of Barcelona
Leader researcher:	Josep Mas Pla
Amount for ICRA:	€ 144,900

PROJECT	
Impacto de la contaminación de origen agrícola en la calidad hidroquímica (nitratos, antibióticos) y microbiológica (genes de resistencia) Retos17_IMPACT	
Funding agency:	Ministerio de Asuntos Económicos y Transformación Digital (MINECO) y el Fondo Europeo de Desarrollo Regional (FEDER)
Duration:	2018-2022
Coordination:	University of Barcelona
Leader researcher:	Josep Mas Pla
Amount for ICRA:	€104,665

PROJECT	
Inventive forecasting tools for adapting water quality management to a new climate (InventWater)	
Funding agency:	EUROPEAN COMMISSION
Duration:	2021-2025
Coordination:	ICRA
Leader researcher:	Rafael Marcé
Amount for ICRA:	€726,596.79

PROJECT	
Alteration of carbon sinks and sources in shrinking inland waters: ecosystem metabolism (Alter-C)	
Funding agency:	Agencia Estatal de Investigación (AEI)
Duration:	2021-2024
Coordination:	University of Barcelona
Leader researcher:	Rafael Marce
Amount for ICRA:	€ 145,200

PROJECT	
City runoff pollution impacts on river biodiversity under extreme climatic events (CityPoll) (TED2021_CityPoll)	
Funding agency:	Agencia Estatal de Investigación (AEI), Mecanismo para la Recuperación y la Resiliencia (MRR)
Duration:	2022-2024
Coordination:	ICRA
Leader researcher:	Sergi Sabater
Amount for ICRA:	€ 230,000

PROJECT	
Integració d'estat ecològic i serveis ambientals per al disseny i priorització de mesures de gestió (EESAM)	
Funding agency:	Catalan Water Agency
Duration:	2020-2022
Coordination:	Catalan Institute for Water Research (ICRA)
Leader researcher:	Vicenç Acuña
Amount for ICRA:	€127,422

PROJECT	
Mainstreaming Ecological Restoration of freshwater-related ecosystems in a Landscape context: INnovation, upscaling and transformation (MERLIN)	
Funding agency:	EUROPEAN COMMISSION
Duration:	2021-2025
Coordination:	UNIVERSITAET DUISBURG- ESSEN
Leader researcher:	Vicenç Acuña
Amount for ICRA:	€96,000

PROJECT	
El papel de la eliminación de represas en la restauración del equilibrio morfosedimentario y flujos de carbono en redes fluviales (TED2021_UNDAMMED)	
Funding agency:	Agencia Estatal de Investigación (AEI), Mecanismo para la Recuperación y la Resiliencia (MRR)
Duration:	2022-2024
Coordination:	ICRA
Leader researcher:	Rafael Marce
Amount for ICRA:	€ 85,100



WATER QUALITY AND SAFETY RESEARCH AREA

PROJECT	
REWATERGY - Sustainable Reactor Engineering for Applications on the Water-Energy Nexus	
Funding agency:	EUROPEAN COMISSION
Duration:	2019-2023
Coordination:	Rey Juan Carlos University
Leader researcher:	Sara Rodríguez
Amount for ICRA:	€0.00 (ICRA participates only as Partner Organisation)

PROJECT	
Exploring the contribution of bacteriophages to the emergence and spread of antibiotic resistance in environmental settings (ENVIROSTOME)	
Funding agency:	EUROPEAN COMISSION
Duration:	2019-2023
Coordination:	ICRA
Leader researcher:	José Luís Balcázar
Amount for ICRA:	€170,121.60

PROJECT	
NOWELTIES: Joint PhD Laboratory for New Materials and Inventive Water Treatment Technologies. Harnessing resources effectively through innovation	
Funding agency:	EUROPEAN COMISSION
Duration:	2019-2023
Coordination:	ICRA
Leader researcher:	Mira Petrovic
Amount for ICRA:	€862,334.64

PROJECT	
Contribution of bacteriophages to the spread of anti-biotic resistance in the environment (SfAM)	
Funding agency:	Society for Applied Microbiology (SfAM)
Duration:	2020-2022
Coordination:	ICRA
Leader researcher:	José Luís Balcázar
Amount for ICRA:	€10,850.00

PROJECT	
EMERGE - Evaluation, control and Mitigation of the EnviRonmental impacts of shippingG Emissions	
Funding agency:	EUROPEAN COMISSION H2020
Duration:	2020-2024
Coordination:	ILMATIETEEN LAITOS, Finland
Leader researcher:	Mira Petrović
Amount for ICRA:	€399,968.75

PROJECT	
Dissemination of Antibiotic Resistance by Aquatic Birds: disentangling the contribution of microbes, bird ecology and anthropogenic pollution (DARABi)	
Funding agency:	Agencia Estatal de Investigación (AEI)
Duration:	2020-2023
Coordination:	University of Sevilla
Leader researcher:	Carles Borrego More
Amount for ICRA:	€159,720.00

PROJECT	
Herramienta de escaneo de huellas moleculares de materia orgánica disuelta para la predicción de la formación de subproductos de desinfección durante el tratamiento del agua (Scan2DBP)	
Funding agency:	Agencia Estatal de Investigación, Ministerio de Ciencia e Innovación/ y la Unión Europea NextGenerationEU/ PRTR
Duration:	2021-2023
Coordination:	ICRA
Leader researcher:	Maria José Farre Olalla
Amount for ICRA:	€126.500,00

PROJECT	
REST-RESIST: Antibiotics of restricted use and corresponding resistant genes: tracking their emergence and fate in the environment and assessing natural and engineered attenuation processes to mitigate their spread	
Funding agency:	AGAUR
Duration:	2021-2024
Coordination:	ICRA
Leader researcher:	Sara Rodríguez Mozaz
Amount for ICRA:	€144,300.00

PROJECT	
Phage treatment and wetland technology as intervention strategy to prevent dissemination of antibiotic resistance in surface waters (PhageLand)	
Funding agency:	Agencia Estatal de Investigación, Ministerio de Ciencia e Innovación/ y la Unión Europea NextGenerationEU/ PRTR
Duration:	2021-2024
Coordination:	ICRA
Leader researcher:	Carles Borrego
Amount for ICRA:	€264,270.00

PROJECT	
Antibiotic REsistaNce and Pathogenic Signature in Marine and Freshwater Aquaculture Systems (ARENA)	
Funding agency:	Agencia Estatal de Investigación, Mecanismo para la Recuperación y la Resiliencia (MRR)
Duration:	2021-2024
Coordination:	National Research Council (CNR) Italy
Leader researcher:	Sara Rodriguez Mozaz
Amount for ICRA:	€150,000

PROJECT	
RECYCLing waste water from small and medium sized laundries with advanced Oxidation process (LIFE-RECYCLO)	
Funding agency:	EUROPEAN COMISSION
Duration:	2021-2024
Coordination:	TREEWATER SAS, France
Leader researcher:	Sara Rodriguez Mozaz
Amount for ICRA:	€74,140

PROJECT	
Small-molecule mass spectrometry fingerprinting as a diagnostic tool in water quality control and treatment optimization (waterDOM)	
Funding agency:	Agencia Estatal de Investigación (AEI)
Duration:	2021-2024
Coordination:	ICRA
Leader researcher:	Maria Jose Farre Olalla
Amount for ICRA:	€181,500

PROJECT	
Integrating nature-based water ReUse strategies with advanced Monitoring of the Presence and impact of MicroPollutants and MicroPlastics (ReUseMP3)	
Funding agency:	Agencia Estatal de Investigación (AEI)
Duration:	2021-2024
Coordination:	ICRA
Leader researcher:	Sara Rodriguez
Amount for ICRA:	€174,240

PROJECT

Dynamics of communities and Evolution of Antibiotic Resistance in Wastewater (MSCA- DEAR-Waste-Marie Rescan)

Funding agency: EUROPEAN COMISSION

Duration: 2022-2024

Coordination: ICRA

Leader researcher: Carles Borrego

Amount for ICRA: €181,152.96

PROJECT

INNOVATIVE TOOLS TO CONTROL ORGANIC MATTER AND DISINFECTION BYPRODUCTS IN DRINKING WATER (intoDBP)

Funding agency: EUROPEAN COMISSION

Duration: 2022-2026

Coordination: ICRA

Leader researcher: Maria José Farré

Amount for ICRA: €780,507.50

TECHNOLOGIES AND ASSESSMENT

PROJECT

Three-dimensional nanoelectrochemical systems based on low-cost reduced graphene oxide: the next generation of water treatment systems (ELECTRON₄WATER)

Funding agency: European Commission

Duration: 2017-2023

Coordination: ICRA

Leader researcher: Jelena Radjenovic

Amount for ICRA: €1,493,733.13

PROJECT

SCOREwater: Smart City Observatories implement REsilient Water Management

Funding agency: European Commission

Duration: 2019-2023

Coordination: IVL (Sweden)

Leader researcher: Lluís Corominas

Amount for ICRA: €388,511.75

PROJECT

DESENVOLUPAMENT D'EINES PER AL SUPORT EN LA IMPLEMENTACIÓ I GESTIÓ DE LA REUTILITZACIÓ (SUGGEREIX)

Funding agency: Catalan Water Agency (ACA)

Duration: 2020-2022

Coordination: Eurecat (CTM)

Leader researcher: Wolfgang Gernjak

Amount for ICRA: €65,606.85

PROJECT

Innovative WATER recoverY Solutions through recycling of heat, materials and water across multiple sectors (iWAYS)

Funding agency: EUROPEAN COMISSION

Duration: 2020-2024

Coordination: UNIVERSITA DEGLI STUDI DI MODENA E REGGIO EMILIA, Italy

Leader researcher: Wolfgang Gernjak

Amount for ICRA: €583,980.00

PROJECT

COST ACTION- Plasma applications for smart and sustainable agriculture (PIAgri)

Funding agency: EUROPEAN COMISSION

Duration: 2020-2024

Coordination: Institute of Physics Belgrade Serbia

Leader researcher: Wolfgang Gernjak

Amount for ICRA: €0 (COST Action covers only the networking activities expenses (travels) rather than research and as such and they are reimbursed directly to individual participants)

PROJECT

WASTEwater as a source of knowledge on SARS-CoV-2 and other potentially pandemic VIRuses: a One Health approach (VIRWASTE)

Funding agency: Agència de Gestió d'Ajuts Universitaris i de Recerca (AGAUR)

Duration: 2021-2022

Coordination: University of Barcelona (UB), Laboratori de Virus Contaminants d'aigües i aliments.

Leader researcher: Lluís Corominas Tabares

Amount for ICRA: €0 (The ICRA budget is allocated to UB. Expenses will be paid from there.)

PROJECT	
INtegrated and adaptiVE management of river basins: developing STRategies for optimized investments in urban water infrastructure (INVEST)	
Funding agency:	Agencia Estatal de Investigación (AEI), Ministerio de Ciencia, Innovación y Universidades (MICIU) y el Fondo Europeo de Desarrollo Regional (FEDER)
Duration:	2019-2022
Coordination:	ICRA
Leader researcher:	Wolfgang Gernjak
Amount for ICRA:	€133,100

PROJECT	
Analysis of antibiotic resistance and micropollutants biotransformation: bioRGO-enhanced anaerobic MBR and elucidation of degradation products (ANTARES)	
Funding agency:	Agencia Estatal de Investigación (AEI)
Duration:	2020-2023
Coordination:	Universidad de Santiago
Leader researcher:	Jelena Radjenovic
Amount for ICRA:	€137,335.00

PROJECT	
Edible Cities Network Integrating Edible City Solutions for social resilient and sustainably productive cities (EdiCitNet)	
Funding agency:	EUROPEAN COMISSION
Duration:	2018-2023
Coordination:	Humboldt-Universität zu Berlin, Germany
Leader researcher:	Joaquim Comas
Amount for ICRA:	€427,780

PROJECT	
Demonstration of water loops with innovative regenerative business models for the Mediterranean region (HYDROUSA)	
Funding agency:	EUROPEAN COMISSION
Duration:	2018-2023
Coordination:	National Technical University of Athens
Leader researcher:	Gianluigi Buttiglieri
Amount for ICRA:	€474,300

PROJECT	
Cost Action: Implementing nature-based solutions for creating a resourceful circular city (Circular City Re.Solution)	
Funding agency:	EUROPEAN COMISSION
Duration:	2018-2023
Coordination:	Universität für Bodenkultur Wien (BOKU, Austria)
Leader researcher:	Gianluigi Buttiglieri
Amount for ICRA:	€0 (COST Action covers only the networking activities expenses (travels) rather than research and as such and they are re-imbursed directly to individual participants)

PROJECT	
DIGITAL-WATER.city - Leading urban water management to its digital future (DWC)	
Funding agency:	EUROPEAN COMISSION
Duration:	2019-2022
Coordination:	KWB KOMPONENTENTZZENTRUM WASSER BERLIN GEMEINNUTZIGE GMBH (KWB), Germany
Leader researcher:	Oriol Gutierrez
Amount for ICRA:	€193,750

PROJECT	
MICROWATER	
Funding agency:	EUROPEAN COMISSION
Duration:	2020-2023
Coordination:	ICRA
Leader researcher:	Maite Pijuan
Amount for ICRA:	: €259,398.72

PROJECT	
Avaluació de la propagació de la COVID-19 mitjançant epidemiologia de les aigües residuals: tipatge, cribatge comunitari i risc ocupacional (EPISARS).	
Funding agency:	Fundació La marató de TV3. Código: 202103-31
Duration:	2021-2023
Coordination:	University of Barcelona
Leader researcher:	Lluís Corominas Tabares
Amount for ICRA:	€95,100.00

PROJECT	
Spread Sewer Sensing for Sustainable Management (4SM)	
Funding agency:	Agencia Estatal de Investigación, Ministerio de Ciencia e Innovación/ y la Unión Europea NextGeneration EU/PRTR
Duration:	2021-2024
Coordination:	ICRA
Leader researcher:	Oriol Gutiérrez Moreno
Amount for ICRA:	€299,999.39

PROJECT	
ModULar Tools for Integrating enhanced natural treatment SOLUTIONs into Urban waterR CycleS (MULTISOURCE)	
Funding agency:	EUROPEAN COMISSION
Duration:	2021-2025
Coordination:	INSTITUT NATIONAL DE RECHERCHE POUR L'AGRICULTURE, L'ALIMENTATION ET L'ENVIRONNEMENT, France
Leader researcher:	Joaquim Comas
Amount for ICRA:	€326,500

PROJECT	
Hacia la protección de la economía circular del agua de la amenaza que suponen los compuestos químicos persistentes, móviles y tóxicos (TED2021_NEPMTUNE)	
Funding agency:	Agencia Estatal de Investigación (AEI), Mecanismo para la Recuperación y la Resiliencia (MRR)
Duration:	2022-2024
Coordination:	Universidad de Santiago de Compostela
Leader researcher:	Jelena Radjenovic
Amount for ICRA:	€184,000

PROJECT	
Valorizando metano: biorefinería basada en metanótrofos para la producción de polímeros extracelulares (TED2021_CH4-BIOPOL)	
Funding agency:	Agencia Estatal de Investigación (AEI), Mecanismo para la Recuperación y la Resiliencia (MRR)
Duration:	2022-2024
Coordination:	ICRA
Leader researcher:	Maite Pijuan
Amount for ICRA:	€206,655

PROJECT	
Control of water quality risks in planned and de facto potable reuse (TED2021_reclaimONEwater)	
Funding agency:	Agencia Estatal de Investigación (AEI), Mecanismo para la Recuperación y la Resiliencia (MRR)
Duration:	2022-2024
Coordination:	ICRA
Leader researcher:	Wolfgang Gernjak
Amount for ICRA:	€ 310.500,00

PROJECT	
Sustainable water reuse practices improving safety in agriculture, food and environment (PCI2021_SAFE)	
Funding agency:	Agencia Estatal de Investigación (AEI)
Duration:	2022-2025
Coordination:	Università degli Studi della Basilicata (UNIBAS)
Leader researcher:	Gianluigi Buttiglieri
Amount for ICRA:	€184,000

PROJECT	
Giro hacia la reNaturalización para una Girona más resiliente y saludable - (GiroNat)	
Funding agency:	INSTITUCIO PUBLICA – MRR
Duration:	2022-2025
Coordination:	Ajuntament de Girona
Leader researcher:	Lluís Corominas
Amount for ICRA:	€107,122.95

PROJECT	
Twinning Western Balkans Special- TWINNING FOR SMART WATER- THINKING AND RETHINKING WASTEWATER MANAGEMENT IN CIRCULAR ECONOMY FRAME (SmartWaterTwin)	
Funding agency:	EUROPEAN COMMISSION
Duration:	2022-2025
Coordination:	University of Novi Sad Faculty of Sciences
Leader researcher:	Jelena Radjenovic
Amount for ICRA:	€249,677.50

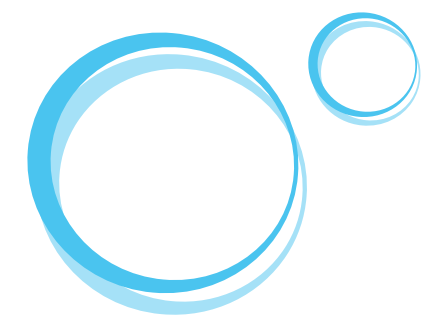




07 Contracts

TOTAL AMOUNT OF
CONTRACTS 2022:

€261,542.20



CONTRACT:	
Cetaqua_NITROUS	
Contracting Entity:	Cetaqua
Duration:	2022-2023
Leader researcher:	Maite Pijuan

CONTRACT:	
CCB_Roses_Olors (ESTUDI DE LA REDUCCIÓ DE D'OLORS, TOXICITAT I CORROSIÓ EN EL SISTEMA DE SANEJAMENT DE LA ROSES (ALT EMPORDÀ).	
Contracting Entity:	UTE Servicio de sistemas de Saneamiento en alta CCB-ELA
Duration:	2022-2023
Leader researcher:	Acuña Salazar, Vicenç

CONTRACT:	
GO-AE_REAQUA (Grup Operatiu Associació Europea DARPA – REAQUA)	
Contracting Entity:	Olot Meats S.A
Duration:	2022-2024
Leader researcher:	Meritxell Gros Calvo

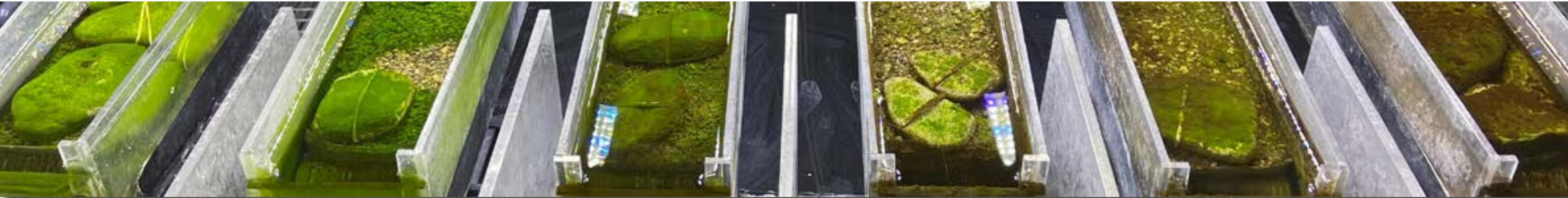
CONTRACT:	
Licitacio_DSU_AdM (Realització de l'estudi d'alternatives per a la gestió de les decàrregues de sistemes unitaris.)	
Contracting Entity:	Aigües de Manresa S.A.
Duration:	2022-2024
Leader researcher:	Lluís Corominas

CONTRACT:	
Licitacio_WBCSD-WIAT (Service Contract to to support the user's adoption of the WIAT 1.0 online tool)	
Contracting Entity:	World Business Council for Sustainable Development (WBCSD)
Duration:	2022-2023
Leader researcher:	Acuña Salazar, Vicenç

CONTRACT:	
Aquasoil_MITO3X (Lab-scale experimental analysis of the MITO3X mixing system)	
Contracting Entity:	Aquasolil
Duration:	2022-2023
Leader researcher:	Wolfgang Gernjak

CONTRACT:	
GO-AE_REAQUA (Grup Operatiu Associació Europea DARPA – FERTIECO)	
Contracting Entity:	Agropecuària Catalana SCCL
Duration:	2022-2024
Leader researcher:	Meritxell Gros Calvo

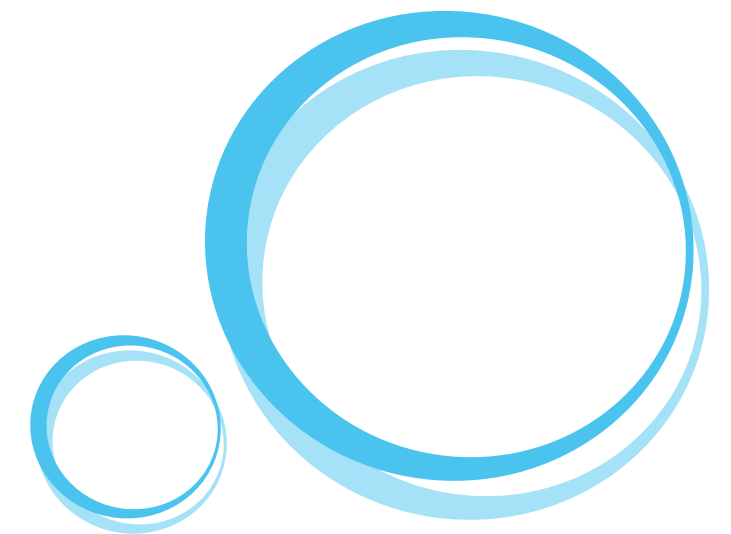
CONTRACT:	
Licitacio_ACA_prioritaries (ANÀLISI DE SUBSTÀNCIES PRIORITÀRIES I ALTRES CONTAMINANTS, SUBSTÀNCIES PREFERENTS, I CONTAMINANTS EMERGENTS EN AIGÜES SUPERFICIALS I SUBTERRÀNIES DE CATALUNYA EN EL PERÍODE 2022-2024)	
Contracting Entity:	ICRA
Duration:	2022-2025
Leader researcher:	Meritxell Gros Calvo





08

Agreements



09/02/2022

AQUASOIL Srl

Scientific collaboration agreement for the development and scientific application of a method patented by the company AQUASOIL.

19/04/2022

Associació de divulgació Científica PINT OF SCIENCE

Collaboration agreement that establishes the conditions for ICRA's sponsorship and participation in the scientific outreach sessions held within the framework of the 2022 Pint of Science festival.

24/02/2022

Universitat de Girona – UdG

Scientific collaboration agreement that aims to establish the conditions for the installation of LEQUIA-UdG equipment in the H2O-ICRA building, which will allow the LEQUIA-UDG group to validate and increase the Technology Readiness Level (TRL) of the REnd-head technology in the membrane recycling process.

14/10/2022

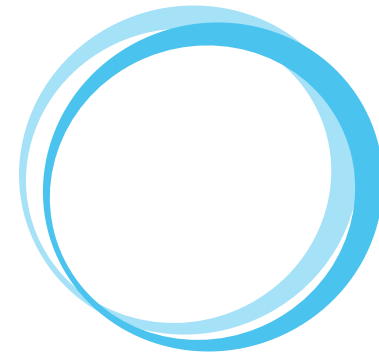
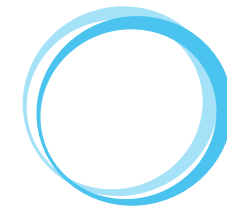
CETaqua

Scientific collaboration agreement that aims to set out the terms and conditions under which ICRA may access and install its equipment in the approved wastewater treatment plants to carry out the agreed sampling within the framework of the NITROUS transfer project.

26/10/2022

Helmholtz Centre for Environmental Research – UFZ

Addendum to the Framework Agreement between UFZ and ICRA signed in 2016, to extend the collaboration until the end of 2027.



14/06/2022

UFMA (Universidade Federal do Maranhao)

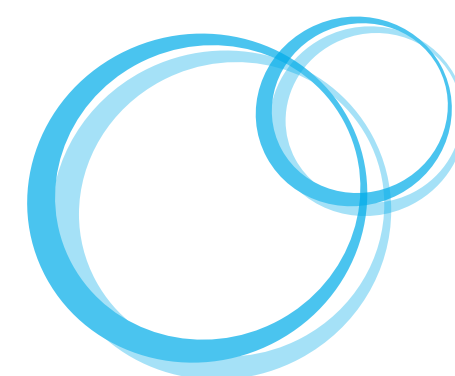
Framework collaboration agreement to govern international cooperation activities between the two institutions, with the aim of planning and executing joint research projects, drawing up formal proposals for funding this research and participating in international calls for proposals, exchanging scientific information, producing joint publications based on joint research activities, exchanging information on recent developments in joint research topics, exchanging staff and scientists, both professionals and students, so that they may participate in joint research programmes, promoting scientific activities, such as short courses, seminars, workshops, conferences of mutual interest, publication exchanges and other academic aspects.

24/11/2022

Club Basquet Girona

Framework collaboration agreement to define and coordinate ICRA and Girona Basketball Club 2014 in implementing measures to improve sustainability by applying local water management and usage technologies and their associated resources. ICRA and Girona Basketball Club 2014 will also take part in exchanges of information, dissemination activities and training, as well as communication activities to promote their joint actions to improve sustainability and contribute to the achievement of the SDGs.





09 Other dissemination activities

19/01/2022

Exposure to emerging contaminants in Barcelona's drinking water. Conference on the AGUA BCN Project

Participation by ICRA in the AGUA-BCN project conference.

What are the emerging contaminants in Barcelona's drinking water? The #AiguaBCN project team has mapped the city to answer this question, and now the research team wants to present their main findings at a conference to be held on 18 and 19 January 2022.

The meeting, which will take place in both face-to-face and virtual formats, will include the talk **Trihalomethanes, haloacetonitriles and non-targeted DBPs in drinking water samples**, given by **Maria José Farré**, on behalf of **ICRA's Water Quality Area (QA)**.

18/02/2022

UdG students show their interest in ICRA at the Faculty of Science's Career Guidance Day

The University of Girona's Faculty of Science invited ICRA researchers to participate, on 10 February, in the 2022 Career Guidance Day aimed at 3rd and 4th-year undergraduates and Master's degree students with the aim of introducing them to the professional and research world.

The heads of ICRA's research areas, **Vicenç Acuña**, from Resources and Ecosystems, **Mira Petrovic**, from Water Quality, and **Maite Pijuan**, from Technologies and Evaluation, held 15-minute interviews with UdG students interested in the internship opportunities offered by the Institute, from career internships to doctoral studies, as well as offers of insertion into the world of work.



28/02/2022

ICRA RESEARCH: 4SM Spread Sewer Sensing for Sustainable Management

At the end of 2021, the 4SM Spread Sewer Sensing for Sustainable Management project was launched, which was awarded under Mineco's call for R&D&I projects in strategic lines of public-private collaboration.

The main objective of 4SM is to create a new set of sensors and tools for the advanced and sustainable management of sewer systems. 4SM addresses four of the most important challenges/opportunities for optimal sewer management: promoting the digitisation of sewer networks, improving the capabilities of current monitoring tools, harnessing sewer resources and energy, and developing highly innovative methods of controlling corrosion, toxicity and odours.

4SM aims to simultaneously develop innovative methods of advanced sustainable infrastructure management while accelerating the connection between the physical and digital world in urban sanitation systems. The project, led by researcher Oriol Gutierrez from ICRA's Technology and Evaluation Area (TiA), has two industrial partners, FACS and Eurecat.

01/03/2022

ICRA participates in the CWP's Water Innovation Day

Joaquim Comas, researcher for ICRA's Technology and Evaluation (TiA) Area, took part in the "Digital and Circular Solutions" Water Innovation Day organised by the Catalan Water Partnership (CWP) on 24 February.

During the conference, which was held at the World Trade Center in Barcelona and attended by more than 170 professionals from the sector, new R&D&I initiatives and digital solutions were presented and shared by CWP partners. Dr Joaquim Comas, representing ICRA, gave a talk on "RWATnet: optimal design of reclaimed water distribution networks".

07/03/2022

Course: Analysing Microplastics in Water (PITCON 2022)

Dr Damià Barceló, director of ICRA took part in the PITCON 2022 congress (Atlanta, Georgia, USA), imparting a course entitled 'Analysing Microplastics in Water'.

08/03/2022

ICRA celebrates the International Day of Women and Girls in Science and International Women's Day with two travelling exhibitions

During the months of February and March, two travelling exhibitions were on display at ICRA to celebrate the International Day of Women and Girls in Science on 11 February and International Women's Day on 8 March.

The first exhibition is a collection that showcases female researchers who have played a prominent role in science. This exhibition is located in the reception area of the ICRA building and aims to highlight female scientists in STEM (Science, Technology, Engineering and Mathematics) careers.



The second exhibition focuses on women who have made a significant contribution to inland water research (limnology). Currently, more than half of the limnologists in training are women. Even so, as in other disciplines, their presence decreases notably in the higher echelons of scientific careers. This exhibition presents a historical retrospective of the most renowned women limnologists, both internationally and in the Iberian Peninsula. In addition, it paints a simple and illustrative picture of the situation of women in limnology and their prospects for the future.

11/03/2022

ICRA celebrates World Water Day with a collection of 12 articles on groundwater

The Catalan Institute for Water Research (ICRA) announces the publication of a compilation of 12 articles on groundwater written by its director, **Damià Barceló** for MethodsX. The collection is freely available to everyone and has been released to mark World Water Day, which is celebrated on 22 March.

The articles address the main groundwater challenges, such as issues around quality and quantity. They also look at practicalities, offering potential solutions using state-of-the-art methodologies. **Damià Barceló**, director of ICRA, assures that the compilation "will be of help to environmental scientists, especially hydrologists, as well as those new to the sector, PhD students and senior researchers who regard groundwater as one of the world's resources in need of protection".

Damià Barceló has also announced a **special virtual issue on the same topic**, also on the occasion of World Water Day 2022. This will allow authors who have not had the opportunity to participate in the collection to publish their articles. Those who have already had their work published can also apply. The submission period will be open from 20 March to 31 October 2022.

15/03/2022

Quarterly compilation of articles published by the TiA team

Over the last 3 months, the research staff working in ICRA's Technology and Evaluation Area (TiA) have published several scientific articles in high-impact journals in their field of research:

- 1) Castellar, J., Torrens, A., Buttiglieri, G., Monclus, H., Arias, C., Carvalho, N., Galvao, A., Comas, J. 2022. Nature-based solutions coupled with advanced technologies: An opportunity for decentralized water reuse in cities. J. Clean. Prod. 340, 130660. <https://doi.org/10.1016/j.jclepro.2022.130660>
- 2) Duinslaeger, N., Radjenovic, J. 2022. Electrochemical degradation of per- and polyfluoroalkyl substances (PFAS) using low-cost graphene sponge electrodes. Water Research 2022, 118148, 10.1016/j.watres.2022.118148
- 3) Ormeno-Cano, N., Radjenovic, J. 2022. Electrochemical degradation of antibiotics using flow-through graphene sponge electrodes, accepted. J. Hazard. Mater. 415, 125557. 10.1016/j.jhazmat.2022.128462
- 4) Solis, B., Guisasola, A., Pijuan, M., Corominas, Ll., Baeza, J.A. 2022. Systematic calibration of N2O emissions from a full-scale WWTP including a tracer test and a global sensitivity approach. Chem. Eng. J. 435, 134733. <https://doi.org/10.1016/j.cej.2022.134733>
- 5) Zahedi, S., Gros, M., Petrovic, M., Balcazar, J.L., Pijuan, M. 2022. Occurrence of veterinary drugs and resistance genes during anaerobic digestion of poultry and cattle manures. Sci. Total Env. 822, 153477. <http://dx.doi.org/10.1016/j.scitotenv.2022.153477>

17/03/2022

ICRA conference on World Water Day 2022: Groundwater: Making the invisible, visible

Groundwater provides almost half of all drinking water worldwide, about 40% of the water required to irrigate agriculture and about a third of the water supply needed for industry. It sustains ecosystems, maintains the base flow of rivers and prevents land subsidence and seawater intrusion. Despite its importance, groundwater is invisible. And out of sight often also means out of mind and understanding.

The Catalan Institute for Water Research (ICRA) is dedicated to research in the field of water and its resources, including groundwater resources, taking a holistic view of the water cycle that includes both qualitative and quantitative aspects.

With this mission in mind, ICRA intends to contribute to the celebration of World Water Day 2022, with a seminar that, over two morning sessions, will address

the following topics:

1. the reality of groundwater supply at a hydrographic confederation level, with emphasis on Catalonia's inland basins, and
2. the current challenges for groundwater in the forthcoming management plans, with speeches from guest lecturers external to ICRA who, with their unquestionable experience, offer a contemporary perspective on the subject and help to disseminate knowledge about groundwater and its importance for human supply and environmental conservation. The purpose of these efforts, as the UN's chosen slogan says, is to make this resource visible and ensure that, given its strategic importance, it receives the necessary attention from the administrative, social and economic spheres.

Seminar format: online

18/03/2022

Publication of the Catalan translation of Groundwater in Our Water Cycle by the Groundwater Project

Getting to Know Earth's Most Important Fresh Water Source, by Eileen Poeter, Ying Fan, John Cherry, Warren Wood and Douglas Mackay, has been translated into Catalan by **Josep Mas-Pla**, a researcher in the Resources and Ecosystems Area at ICRA and lecturer at the University of Girona, and has been published to mark World Water Day 2022, which, with the slogan "making the invisible visible" is dedicated to groundwater.

Groundwater in Our Water Cycle. Getting to Know Earth's Most Important Fresh Water Source discusses the role and importance of groundwater in planet Earth's water cycle. Over the last decade, many books have been published on the growing global water crisis. Yet, while many of them focus on the immense importance of freshwater for humanity and the myriad problems related to water availability, none have been written by hydrological experts that address the groundwater component of the water cycle for a broad audience in such a holistic way as this one does. The book's thesis is unequivocal: groundwater is indispensable for humanity and ecological systems. Especially when human pressure on natural resources is extreme and the impacts are severe. Furthermore, the influence of climate change will make current management models unviable and new forms of management based on environmental protection and social justice will have to be sought. The text argues that groundwater is the least known component of the water cycle and that if we are to tackle the aforementioned challenges implicit in governing this vital natural resource, we need a better understanding

of its dynamics.

The work forms part of the **Groundwater Project**, a non-profit organisation registered in Canada in 2019 committed to contributing to educational advancement and bringing a new perspective to creating and disseminating knowledge to further the understanding and resolution of problems related to water resources. The GW-Project operates from the website gw-project.org, as a global platform for the democratisation of knowledge in hydrogeology.

22/03/2022

ICRA supports World Water Day by highlighting the importance of groundwater

ICRA shares the "Groundwater: making the invisible visible" conference video to mark the 2022 World Water Day

The various presentations offer a contemporary perspective on the subject and help to disseminate knowledge about groundwater and its importance for human supply and environmental conservation.

Groundwater provides almost half of all drinking water worldwide, about 40% of the water required to irrigate agriculture and about a third of the water supply needed for industry. It sustains ecosystems, maintains the base flow of rivers and prevents land subsidence and seawater intrusion. Despite its importance, groundwater is invisible. And out of sight often also means out of mind and understanding.

The Catalan Institute for Water Research **Catalan Institute for Water Research (ICRA)** is dedicated to research in the field of water and its resources, including groundwater resources, taking a holistic view of the water cycle that includes both qualitative and quantitative aspects.

With this in mind, ICRA is supporting **World Water Day 2022**, whose slogan is "**Groundwater: making the invisible visible**", by releasing a video of the conference it organised on 17 March, which brought together experts both from ICRA and from the wider academic, administrative and professional spheres. Each offered a contemporary perspective on the subject and helped to disseminate knowledge about groundwater and its importance for human supply and environmental conservation. They also helped to address the reality of groundwater supply at a hydrographic confederation level, with emphasis on Catalonia's inland basins, and the current challenges around groundwater in the forthcoming management plans.

25/03/2022

1st Campus Water Conference: Research and Territory

ICRA participates in the 1st Campus Water Conference: Research and Territory, organised by the University of Girona. Campus Agua: "Water and the climate emergency in the counties of Girona: challenges and solutions" will take place on the morning of Friday, 25 March, at the University of Girona's Science and Technology Park.

The conference is aimed at administrations, companies, non-profit organisations and other types of entities and individuals who want to inform themselves and/or get involved in climate change adaptation.

04/04/2022

Conclusions from the 2022 World Water Day seminar: Groundwater: Making the invisible, visible

Publication of the conclusions of the online seminar organised by the Catalan Institute for Water Research (ICRA) on 17 March 2022 on the importance of groundwater in supplying both human and ecological needs, with emphasis on its role in supply and the new challenges emerging in the field of researching and managing this resource.

The activity was attended by 83 participants and was organised to mark World Water Day 2022, which this year is dedicated to groundwater. The session featured contributions from speakers Emilio Custodio (UPC, ULPGC), Mireia Iglesias (ACA), Lluís Sala and Agustí López-Fàbrega (CCB-Gi), Anna Menció (UdG), Albert Soler y Gil (UB), Ester Vilanova (Amphos 21), Viviana Re (University of Pisa), Damià Barceló (ICRA) and Josep Mas-Pla (ICRA, UdG).

The **most salient messages from the experts** were the following:

- Groundwater is a vital resource, often of good quality, and a long-term strategic reserve, but there is a conflict between human and environmental uses that needs to be resolved through knowledge and research.
- It is a resource that is intensively exploited in many places, causing problems in terms of both quantity and quality. These problems must be addressed through complex governance and proper planning.
- In terms of Catalonia's inland basins, 82% of the groundwater bodies are in good quantitative condition, but only 43% are in good qualitative condition. The main qualitative issue is nitrate pollution.

- The Inland Basins 2022-27 River Basin District Management Plan sets out the needs, pressures and impacts and proposes appropriate measures. Together with the 2020 Drought Plan, the Management Plan assesses groundwater as a strategic resource to guarantee supply and environmental conservation.
- The local vision of resource management, as in the case of the Costa Brava, must be based on the United Nations Sustainable Development Goals. In addition, greater importance should be given to hydro-social aspects in planning schemes, and there must be a shift towards a more cross-cutting, decentralised, comprehensive and adaptive water cycle model.
- Many aquatic ecosystems depend on groundwater flows to maintain their biodiversity. Groundwater flow provides the necessary volumes of water when precipitation is scarce and regulates hydrogeochemical cycles, including denitrification, allowing habitats to develop appropriately.
- Groundwater has been exposed to an influx of pollutants for decades, and the accumulated mass of pollutants creates a serious problem with an inertia that can persist for decades despite natural attenuation processes that (slowly) remove various types of contaminants. In-situ or ex-situ decontamination are two timely groundwater improvement solutions based on a wide range of technological strategies. A paradigm shift is needed with solutions based, wherever possible, on reproducing natural processes to make aquatic environments more resilient to quality loss and integrating the circular economy concept in decontamination interventions.
- Research provides the foundation for knowledge and management. Artificial intelligence methods applied to hydrological management, based on machine learning, allow databases to deliver their full potential by predicting results at a low cost and with a high degree of certainty, complementing both the fieldwork and the information derived from it, as well as the conceptual and numerical models that describe hydrogeological processes. It represents a novel approach to hydrogeological knowledge and, therefore, has huge potential for water resources management.
- The needs and perspectives of people, integrated in diverse and interconnected social and economic groups, are one of the most important and, at the same time, least considered aspects of water management approaches. Water, as a scarce resource, generates conflicts between users. The socio-hydrogeological perspective provides a transdisciplinary outlook based on the knowledge and analysis of hydrological and social data, which makes it possible to address and resolve these conflicts by bridging the gap between science and society.

- It is, therefore, necessary to make groundwater visible by linking science and society and fostering governance. In this context, it's important to recognise user communities as successful examples that work every day to bring together users and managers. Without this daily endeavour to monitor, record data and plan, the abuse of groundwater, resulting from ignorance of the water cycle, can lead to consequences that are difficult to remedy.

Lastly, during the seminar, tribute was paid to Professor Dr M. Ramón Llamas Madurga (1931-2022), who used his considerable expertise to further hydrogeology in Spain and throughout the world, becoming a scientific and personal mentor for many people involved in the field of groundwater.

14/04/2022

Pittcon 2022 Conference Highlights - Plastic Pollution: Advancing The Science To Better Manage Micro- And Nano-Plastics

Pittcon is a space for collaborative science, and even though we had to place this year's in-person Pittcon on hold, we still want to share with you the opportunity to connect live with your peers, free of charge, through our virtual Pittcon 2022 Conference Highlights.

You can access our top speakers, researchers, and awardees from the comfort of your home, office, or laboratory – it's the Pittcon experience you know and value, even though it might look a little different this year.

As part of this year's conference, Damià Barceló, director of ICRA, will be presenting the paper Analysis of Microplastics in Water: Focus on Sampling, Sample Preparation and Green Analytical Protocols.

25/04/2022

Conference. Global change and water. Dr. Damià Barceló

CSIC Researchers Residence- (18h) (Streaming Broadcast) Global change and water

25/04/2022

Conference at the CSIC Researchers' Residence (Barcelona)

By: Dr Damià Barceló (Research Professor at IDAEA-CSIC and Director of the Catalan Institute for Water Research ICRA-CERCA)

In many regions, water consumption exceeds water availability, resulting in numerous challenges for water management. Future climate change scenarios point to water shortages in several parts of the world, including the Mediterranean, with extreme episodes of flooding and droughts. At this conference, we will discuss various aspects relating to water quantity and quality in the Mediterranean region and Europe, such as the fate, risk and removal of emerging pollutants and microplastics in a context of global change. In particular, we'll look at how water scarcity negatively influences water quality and the recent negative consequences of COVID-19 for water. The results presented were financed by several different projects, including GLOBAQUA, SCARCE and the I-LINK +2019 B20030 project.

Live streaming broadcast

26/04/2022

ICRA researcher Jelena Radjenovic, winner of the 2021 National Young Talent Research Award for her work on water treatment with graphene sponges

The Government of Catalonia and the Catalan Foundation for Research and Innovation (FCRI) have awarded **Dr Jelena Radjenović**, ICREA research professor at the Catalan Institute for Water Research (ICRA), where she directs the European project Electron4water, with the 2021 National Research Award in the Young Talent category.

The National Research Awards recognise and reflect the different facets of both research activity and initiatives in scientific communication and dissemination, scientific patronage and public and private cooperation in R&I projects in Catalonia. The National Research Award Young Talent category aims to stimulate and recognise the efforts of young researchers in the Catalan research and innovation system who have contributed during their professional career to the advancement of a scientific discipline in any of its fields. Other aspects, such as technology transfer and the social impact of their research, are also assessed.

In the case of Dr Jelena Radjenović, the prize was awarded for her work on the Electron4water project, in which she developed low-cost graphene sponge nanostructured electrodes for water treatment. These new elements are the first to enable the electrochemical treatment of persistent, toxic and carcinogenic water pollutants, such as perfluorinated compounds, without producing the toxic by-products typically observed in electrochemical treatments using commercial materials.

04/05/2022

ICRA sponsors the Pint of Science Festival in Girona

Bars offer a relaxed and informal atmosphere for discussions on any topic, so why not science as well? This is the idea behind next week's Pint of Science festival, which the [Catalan Institute for Water Research \(ICRA\)](#) is sponsoring and promoting.

The Pint of Science festival is an international science outreach event that takes place simultaneously in several countries worldwide and in various cities in Spain. The festival invites scientists to share their knowledge and research in bars, thus making science accessible to everyone.

Girona is one of the cities hosting the Pint of Science festival on 9, 10 and 11 May. Over the course of the three days, several talks will be held in the bars taking part in the festival. There will also be complementary activities such as competitions, live music and games.

A total of 12 researchers will be participating in the Girona edition, 6 of whom work at ICRA. Anna Segué Codina, Elisabeth Cuervo, Natalia Ormeño Cano, Oriol Casabella Font, Dídac Jordà Capdevila and Joan Saló Grau will discuss topics including water treatment and technology and emerging pollutants and environmental flows, among others, through a range of thought-provoking talks on topics such as: "Arsenic: the king of water poisons"; "Can solar radiation assist in the treatment and disinfection of water?"; "Antibiotic-Resistant Bacteria: are we facing the next pandemic?"; "Environmental cabals. Between fish and people", and "The problems of industrial pollutants".



05/05/2022

An INOWASIA delegation visits ICRA to learn more about its research on water challenges in Southeast Asia



A delegation of INOWASIA project partners, coordinated by Lequia UdG at the University of Girona, visited ICRA on 4 May to learn more about how the Institute works and the research being carried out. INOWASIA is an international project that aims to train a new generation of young water professionals in Southeast Asia to address water challenges in the region: water scarcity and sanitation, droughts and floods, deforestation and threats to biodiversity, among others. In this context, the visit to the ICRA was seen as a valuable opportunity for knowledge exchange and networking.

The visit began with a welcome from Damià Barceló, director of ICRA, and a presentation on ICRA's research services and success stories by Maite Pijuan, head of the Technologies and Evaluation Area. Xavier Xirgu then presented the work of the Girona Region of Knowledge Foundation as a partner of the INOWASIA project, followed by Ignasi Rodríguez Roda from Lequia UdG, who spoke about the objectives of INOWASIA. The round of speeches ended with presentations by representatives from six of the project's seven partner universities, who also attended the event: Vietnam National University Hanoi (Hanoi), Can Tho University (Ho Chi Minh), National University Of Laos (Vientiane), Souphanouvong University (Luang Prabang), Institute Of Technology Of Cambodia (Phnom Penh) and the University Of Battambang (Battambang).

The visit ended with a tour of ICRA's facilities and laboratories, during which the members of the delegation were shown the Artificial Rivers Plant, learnt how the Pilot Wastewater Treatment Plant works and were given an explanation of what ICRA's Scientific and Technical Services consist of and how the Biological and Molecular Techniques Unit works.

06/05/2022

Dr Damià Barceló receives an honorary doctorate from the University of Almería after 30 years of collaboration

"The reuse of reclaimed water for growing food would not cause health problems for people", was one of the statements made by the new honorary doctor of the [University of Almería \(UAL\)](#), [Damià Barceló Cullerès](#), director of the [Catalan Institute for Water Research \(ICRA\)](#), in his investiture speech. Barceló noted that this was the conclusion reached by one of the most recent studies he has conducted with the team of Prof. Amadeo R. Fernández-Alba, from the University of Almería, who acted as sponsor during the investiture ceremony.

The study set out to determine the levels and possible risks to human health caused by the residues of 30 emerging contaminants from different chemical groups in agricultural irrigation waters and their potential absorption by tomatoes. "The conclusion of this study can be summarised as follows: an adult would have to consume more than 100 kilos of tomatoes a day for it to have any harmful effect on their health," Barceló summarised graphically.

The ICRA director's investiture speech was divided into five sections corresponding to his scientific biography: the beginning in the assembly of mass spectrometry with liquid chromatography as an analytical technique; the studies of emerging pollutants in natural and wastewater; wastewater treatment and reuse; the scientific collaboration with the University of Almería; and finally, the studies on the epidemiology of wastewater.

During his speech, Barceló highlighted his close collaboration with the UAL group, which dates back to 1992, 30 years ago: "I accept this honour with great joy, coming as it does from a University with which I have long-standing close professional and personal ties". And, to illustrate the worldwide impact of this scientific collaboration, he referred to two of the joint studies that have resulted in numerous publications. The first was one of the first studies to determine the environmental risk posed by pharmaceuticals in wastewater, natural waters and sediments. It was published in 2006, signed as the first author by María Dolores Hernando, who carried out postdoctoral studies in Barceló's laboratory, and has so far obtained 1600 citations according to Google Scholar. The second was the work signed by María José Gómez as the first author, who also worked in Barceló's laboratory, as well as Mira Petrovic from CSIC, also published in 2006, which describes an analytical method for determining 16 drugs from different chemical groups in water using tandem LC-MS and which was applied to determine the drugs present in hospital effluents. According to Google Scholar, this work has now received more than 600 citations and was ground-breaking in its time, as the contribution of hospital drug waste to sewage networks had only just begun to be studied at a 'European' level.

The rector of UAL, **Carmelo Rodríguez Torreblanca**, highlighted Barceló's "international stature, his reputation as a leading figure in environmental matters and particularly in the field of water management and quality, whose global contributions to the fight against climate change have been considerable". "Furthermore, his ability to stimulate genuine interest in others, promote awareness and lead the way in his field of knowledge, the environment and, more specifically, the development of methods to control organic water pollution caused by so-called 'emerging pollutants', are justly deserving of the recognition we bestow on him today and make him more than worthy of this accolade".

For his part, the sponsor of Damià Barceló Cullerès, Professor **Amadeo R. Fernández-Alba**, said that "the opportunity to sponsor this doctorate is a tremendous honour that allows me to highlight, albeit briefly, a life truly dedicated to scientific work which, without doubt, serves as an example and guide for many of us, including the new generations of researchers like the ones we're celebrating here today. Evidently, Professor Barceló is an exceptional scientist in the field of Environmental Chemistry, with whom I have had the good fortune to share much work and many projects and ideas. I would especially like to highlight his collaboration in the training of highly qualified students in both the CSIC and UAL groups, such as María Dolores Hernando, María José Gómez, Serge Chiron and Imma Ferrer".

10/05/2022

IMPACT: Innovative monitoring to prioritise contaminants of emerging concern for Ireland

WEBINAR - DCU Water Institute

SESSION 1

9.00 - 9.30 Prof Damià Barceló Cullerès, Catalan Institute for Water Research, Girona, Spain

Mass spectrometry in wastewater-based epidemiology for the determination of small & large molecules as biomarkers of exposure. Needs for COVID-19 testing with environmental proteomics.

9.30 - 9.45 Dr Helena Rapp Wright, Environmental Research Group, Imperial College London, UK

Novel detection and risk assessment of contaminants of emerging concern in a range of aquatic matrices in Ireland

9.45 - 10.00 Imogen Hands, DCU Water Institute, School of Chemical Sciences, DCU, Ireland

Occurrence of chemicals of emerging concern in Irish waters, with a focus on pesticide contaminants.

SESSION 2

10.30 - 10.45 Prof Fiona Regan, DCU Water Institute, School of Chemical Sciences, DCU, Ireland

Chemicals in our Water: Analytical Challenges to Assess Risk

10.45 - 11.00 Dr. Marcin Penk, School of Natural Sciences, Trinity College Dublin, Ireland

Acute toxicity of the insecticide cypermethrin to three common European mayfly and stonefly nymph

11.00 - 11.45 Simon O'Toole, Environmental Monitoring and Surveillance, EPA, Ireland

The National Aquatic Environmental Chemistry Group - an improved strategic approach to the monitoring and management of hazardous chemicals in the aquatic environment.

SESSION 3

12.30 Dr. Leon Barron, Environmental Research Group, School of Public Health,

Faculty of Medicine, Imperial College London, UK

Rapid and lower cost approaches for monitoring the risks of emerging contaminants at scale

12.30 - 1.00 Roundtable discussion "Future directions for CEC analysis"

Panelists: Prof Damià Barceló, Prof. Fiona Regan, Dr Marcin Penk, Simon O'Toole, Dr Leon Barron

23/05/2022

The iWAYS project: full speed ahead

The **iWAYS H2020 project** - Innovative Water Recovery Solutions through the recycling of heat, materials and water in multiple sectors - is finalising the specifications of the three use cases in Spain, Italy and Sweden. They were discussed at the consortium meeting held at the scientific coordinator's institution - Brunel University, London - on 18-19 May.

Specifically, the ICRA project team consisting of W. Gernjak (LR), M. Abily and A. Tizchang is preparing to launch a public tender for the acquisition of the flotation and membrane distillation pilot plants that will treat and recover the process water for recycling back into the manufacturing process of Tubacex, a steel pipe manufacturing company located in the Basque Country.

23/05/2022

The First Water Summit and the Roy Zuckerberg Prize, Desalination, water treatment, hydrology, and aquatic microbiology

The Jacob Blaustein Institutes for Desert Research - Israel

Inaugural lecture by **Prof. Damià Barceló**, "Macro and micro-plastic litter and increased COVID-19-based plastic pollution in the aquatic environment and landfills: treatment, environmental risks and policy solutions", as part of the conference organised by the **Zuckerberg Institute for Water Research (ZIWR)** and the **Jacob Blaustein Institutes for Desert Research (BIDR)**, at **Ben-Gurion University of the Negev**.

24/05/2022

Discovered in Girona 2022 (Conference Series) May 2022

Girona Provincial Council Cultural Centre

The Discovered in Girona (Descobert a Girona) conference series will take place in May, with the aim of bringing the research carried out by the University of Girona's Department of Biology to Girona society.

The series consists of four sessions in which we will explain the discoveries made by the different research groups that make up the Department.

This year's session will be followed by a closing lecture on the creation and operation of the SARS-CoV-2 wastewater surveillance system in Catalonia by Dr Carlos Borrego. Tenured lecturer at the University of Girona, the Catalan Institute for Water Research (ICRA) and the Molecular Microbial Ecology Group (IEA-UdG)

Closing lecture: SARSAIGUA: Surveillance network for SARS-CoV-2 in wastewater in Catalonia

25/05/2022

Final NOWELTIES scientific conference in Dubrovnik



The final scientific conference of NOWELTIES, a project coordinated by Dr Mira Petrovic of ICRA, took place in Dubrovnik, Croatia, on 11-12 May, hosted by the Faculty of Chemical Engineering and Technology at the University of Zagreb. The main objective of the conference was to present the results of the NOWELTIES research programme as well as new achievements in the field of developing and applying new materials and inventive processes for wastewater treatment, covering four themes: advances in biological wastewater treatment, advances in Advanced Oxidation Processes (AOP), new materials and application of nanotechnology in wastewater treatment and hybrid wastewater treatments. The conference combined keynote presentations by guest speakers with presentations by NOWELTIES grantees and other project participants.

On 13 May, the last face-to-face meeting of the project and a workshop entitled "What happens after NOWELTIES?" was held, focusing on the programme's scientific and entrepreneurial career.

Some of the presentations given by the guest speakers at the final conference are available at the following links:

Alette Langenhoff, Wageningen University, the Netherlands

[Biological treatment technologies for the removal of micropollutants](#)

Urska Lavrenčič Štangar, University of Ljubljana, Slovenia

[The effect of \(waste\)water matrix on photocatalytic degradation of pharmaceuticals](#)

Adrian M.T. Silva, University of Porto, Portugal

[Carbon materials as catalysts in AOPs for water/waste-water treatment](#)

01/06/2022

The Second International Symposium on Nanomaterials and Membrane Science for Water, Energy and Environment

Pre-doctoral researcher Esther Mendoza from ICRA's Technology and Evaluation Area, will present her work entitled "Fertiliser-drawn forward osmosis for greywater treatment" at the Second International Symposium on Nanomaterials and Membrane Science for Water, Energy and Environment which will take place in Tangier (Morocco) on the 1st and 2nd. More information: <https://smmd.ma/>

02/06/2022

ICRA contribution at the International Exhibition and Forum for Afforestation Techniques in Saudi Arabia

The **International Exhibition and Forum for Afforestation Techniques** took place in Saudi Arabia on 29 and 31 May. ICRA Director Damià Barceló was invited as an expert to give a lecture on "Afforestation impacts on hydrological system services".

The exhibition and forum that took place during the gathering aimed to provide a platform to encourage government agencies, semi-governmental organisations, businesses and non-profit organisations to come together as active stakeholders to combat desertification and increase vegetation cover, as well as to present the most important research in this field and contribute to the achievement of the United Nations Sustainable Development Goals.

03/06/2022

Exhibitions at the Second International Symposium on Nanomaterials and Membrane Science for Water, Energy and Environment

Researchers from ICRA's Technology and Evaluation (TiA) area participated in the Second International Symposium on Nanomaterials and Membrane Science for Water, Energy and the Environment, held in Tangier (Morocco), on 1-2 June 2022.

Joaquín Comas delivered the keynote lecture "Decision-support system for the evaluation of water reuse schemes" (J. Comas, X. Amores, G. Buttiglieri, M. Font, W. Gernjak, V. Martí, D. Martínez, M. Mesas and C. Puigdomenech). Meanwhile, Esther Mendoza presented: "Fertiliser-drawn forward osmosis for greywater treatment" (E. Mendoza M. Castaño, G. Blandin, J. Comas, G. Buttiglieri).

Esther Mendoza, ICRA PhD student and Joaquim Comas, ICRA senior researcher, presenting "Desalination and Reuse in the Face of Water Scarcity" at the Second International Symposium on Nanomaterials and Membrane Science for Water, Energy and Environment.

05/06/2022

ASMS Conference on Mass Spectrometry and Allied Topics

ICRA's participation in the ASMS annual conference, this year held in Minneapolis (USA). <https://www.asms.org/>

06/06/2022

ICRA at the XIV Congress of the Spanish Water Treatment Boards

Maite Pijuan, head of ICRA's Technology and Evaluation Area, participated in the XIV Congress of the Spanish Water Treatment Board, which was held in Seville from 1 to 3 June. The congress brings together all the groups from Spanish universities and research centres working on wastewater treatment. Dr Pijuan gave a presentation on the **ANTARES project** funded by the Spanish State Research Agency.

06/06/2022

12th Micropol and Ecohazard Conference

Researchers from the ICRA's Technology and Evaluation Area will be participating in the IWA's 12th international Micropol and Ecohazard conference, which will take place in Santiago de Compostela from 6 to 10 June. This conference is part of the IWA Specialist Group's series of conferences on the "Assessment and Control of Hazardous Substances in Water", which serves as an international forum for discussions around the development of technical solutions concerning emerging contaminants. <https://micropol2022.org>

07/06/2022

ICRA patents a new technology that uses graphene sponges to inexpensively remove persistent pollutants from water without the need for chemical products

The system created by the ICRA team makes it possible to remove PFASs and other emerging pollutants from the aquatic environment using a more sustainable technique that costs between 60 to 120 times less than the techniques that use chemical reagents.

The research is led by ICRA researcher Jelena Radjenović, who will be awarded the 2021 National Research Award for Young Talent today.

The development of nanostructured graphene sponge electrodes for water treatment is a new technology patented by a team of researchers at the [Catalan Institute for Water Research \(ICRA\)](#), which uses no chemicals and costs 60-120 times less than other electrochemical processes. These nanotechnological elements allow, for the first time, persistent water pollutants to be treated electrochemically without producing toxic compounds from chloride oxidation, which is the main drawback of existing electrode materials.

The research forms part of the European **Electron4water** project led by **Jelena Radjenović**, ICREA research professor at ICRA, who will today, Tuesday, 7 June, receive the 2021 National Research Award for Young Talent by the Government of Catalonia and the Catalan Foundation for Research and Innovation (FCRI).

One of the major global concerns is the security of water supplies in the face of climate change and the presence of highly toxic and persistent substances such as perfluoroalkyl compounds (PFAS) in aquatic environments. "In the search for new technologies to remove PFASs and other emerging contaminants, electrochemical processes offer many advantages over other advanced oxidation processes. They only use current without adding chemical reagents and, at the same time, can treat water from any source, from tap water to industrial effluents. They can also break carbon-fluorine bonds, C-F, one of the strongest chemical bonds, overcoming one of the biggest obstacles encountered in advanced oxidation processes," explains **Jelena Radjenović**. However, the mass application of these processes has been limited, in part, by the high cost of the electrodes, ranging from €3,000 to €6,000 per m² and by the generation of highly toxic chlorinated by-products resulting from the oxidation of chloride during treatment, an ion found in all waters.

These limitations are eliminated by the advances made by the ICRA team. The graphene sponges developed offer significant advantages over the materials currently used in commercial electrodes. The cost of producing this material is much lower: less than €50 per m², which makes it highly attractive for large-scale usage. In addition, the synthesis process is easily scalable and allows the sponge to attract and degrade certain groups of organic pollutants, thus increasing the efficiency of the process in complex matrices.

For **Jelena Radjenović**, "New electrochemical systems are the next great breakthrough in water management and treatment (also called water 4.0). This is a major step towards the implementation of decentralised water treatment systems instead of the current system that has been in place for the last 100 years. In the future, for example, we will be able to treat and reuse water on-site in buildings or business parks instead of managing the wastewater and drinking water through a system of WWTPs or DWTPs. And this will enable us to accommodate population growth and supply more remote"

In this context, Jelena insisted on recalling the advantages of the electrochemical system: "They run on current alone and can even be easily attached to solar panels. They do not require the addition of chemical reagents, and there are no production, storage, transport and handling costs. They are small in size (with a modular design) and can be easily automated.

07/06/2022

ICRA participates in the VI Conference of Predoctoral Researchers

The University of Girona's VI Conference of Predoctoral Researchers was held in Girona from 30 May to Thursday, 2 June 2022. The conference was organised by the Doctoral School and the UdG.doc Association.

The conference programme included information sessions, workshops on job placement and talks about the research carried out by the university's doctoral students.

Josephine Vosse, a researcher for the Technologies and Evaluation Area (TiA), presented the project "Reuse of water for irrigation: how to characterise the risk of human exposure to pharmaceuticals accumulated in food crops" (J. Vosse, L. H.M.L.M. Santos, E. Mendoza, J. Comas, S. Rodriguez-Mozaz, G. Buttiglieri.).

13/06/2022

ICRA plays a prominent role in the 12th edition of Micropol & Ecohazard

ICRA was heavily involved in the 12th edition of Micropol & Ecohazard, which took place from 6 to 10 June 2022 in Santiago de Compostela. The conference forms part of the IWA Specialist Group conference series "Assessment and Control of Hazardous Substances in Water" and featured several platform and poster presentations, as well as sessions chaired by ICRA researchers.

The contributions made to the conference were diverse, reporting on research primarily from "Technology and Evaluation" and "Water Quality and Health". The quality of the conference and ICRA's contribution was extremely high, and in fact, **Nikoletta Tsiarta**, an ICRA PhD student working on the NOWELTIES Marie Curie project, won the prize for best poster presentation. In addition, ICRA contributed to the organisation of the event by holding a workshop on New Materials co-chaired by **Mira Petrovic** (ICRA, ICREA) and **Hrovje Kusic** (U. Zagreb). Last but not least, **Wolfgang Gernjak** participated in the young water professionals' workshop prior to the conference round table and introduced ICRA to an interested audience of more than 100 enthusiastic young researchers.

20/06/2022

The GiroNat project gets underway with participation from ICRA

The Biodiversity Foundation has awarded Girona City Council the GiroNat project as part of the European NextGeneration funding. The project has a total budget of €4,200,000, most of which will be managed by the City Council for renaturation projects in the city.

ICRA is leading two tasks with a budget of more than €100,000. The first is the modelling and prioritisation of SUDS (Sustainable Urban Drainage Systems), and the second is the scientific monitoring of a green wall for greywater treatment to be installed in the Sant Narcís civic centre.

21/06/2022

ICRA RESEARCH: inventWater - Inventive forecasting tools for adapting water quality management to a new climate

Climate change, extreme events and seasonal weather variations have a profound impact on water quality in rivers, lakes and reservoirs. This implies the need for tools

that can anticipate the effects of these environmental changes and enable the effective management of aquatic resources. The growing availability of new climate products and advances in modelling tools means that we are now able to produce reliable forecasts for water quality in lakes and rivers at both a regional and global level, an as-yet untapped potential in the water sector. **InventWater** will train a new generation of professionals capable of bringing together fields such as data science, climate, hydrology and freshwater ecology while developing the skills needed to translate knowledge and technical developments into useful products for managers, policymakers and the general public. The project builds on 15 PhD theses on the most innovative aspects of water quality prediction applied to a wide range of problems, from local adaptation to the increase in extreme weather events, including support for climate change adaptation strategies and the achievement of the UN Sustainable Development Goals.

Lead Researcher: Dr. Rafael Marcé, Resources and Ecosystems Area

Partners: ICRA, AARHUS UNIVERSITET, DkIT, UFZ, IIASA, RUHR-UNIVERSITAET BOCHUM, UNIVERSITY OF STIRLING, VRIJE UNIVERSITEIT BRUSSEL, WAGENINGEN UNIVERSITY, UNIVERSITY COLLEGE CORK

Call: H2020-MSCA-ITN-2020 – Innovative Training Networks under the Marie Skłodowska-Curie grant agreement 956623.

22/06/2022

Grand finale of the SUGGEREIX project

The [SUGGEREIX project](#) came to an end this June. The project, funded by the Catalan Water Agency (ACA), provides a Decision Support System (SAD), a guide to foster the implementation and management of wastewater reuse in Catalonia.

On 21 June, the project partners (Eurecat, ICRA, Cetaqua, UPC and the Catalan Water Association) presented the project in Tarragona in front of a broad audience from the water sector. The event also hosted a round table, "Closing the water cycle. Challenges and achievements in Catalonia", with panellists from public and research organisations.

ICRA researchers Joaquín Comas and Wolfgang Gernjak also plan to present the Decision Support System (SAD) internationally at the Water Reuse Europe conference, to be held in Girona next September.

The Decision Support System (SAD) is available free of charge on www.aiguaregenerada.cat

23/06/2022

11th European Conference on Pesticides and Related Organic Micropollutants in the Environment & 17th Symposium on the Chemistry and Fate of Modern Pesticides

23 - 26 June 2022, at the Conference Centre University of Ioannina

ICRA director Damià Barceló is a member of the Scientific Committee of the 11th European Conference on Pesticides and Related Organic Micropollutants in the Environment and the 17th Symposium on the Chemistry and Fate of Modern Pesticides, originally scheduled for 20-23 September 2020 and then for 13-16 June 2021. It has now been rescheduled as the PESTICIDES2022 event to be held on 23-26 June 2022 at the Conference Centre of the University of Ioannina "Karolos Papoulias", Ioannina".

The conference is organised by the Department of Chemistry of the Faculty of Science at the University of Ioannina in cooperation with the Institute for Environment and Sustainable Development (IESD), the Ioannina University Research Centre, the International Association for Environmental Analytical Chemistry (IAEAC), the European-Mediterranean Association for Environmental Education Assessment and Protection (ENEAP), the Gruppo de Ricerca Italiano Fitofarmacio e Ambiente (GRIFA) and the National Research Infrastructure for Comprehensive Food Characterisation (FoodOmics).

The programme will seek to bring together scientists interested in pesticides and the environment and highlight all the latest methodologies, modelling tools and theoretical approaches, attracting researchers from the international scientific community to exchange ideas and report on this serious issue affecting the quality of the natural environment.

At this point, we would like to invite all our colleagues to submit their abstracts and hope to welcome you all at the 11th European Conference on Pesticides and Related Organic Micropollutants in the Environment and the 17th Symposium on the Chemistry and Fate of Modern Pesticides to share experiences with other high-level professors, colleagues and friends, representing many renowned universities and institutes together with members of relevant international organisations.

Conference scientific programme

Summary of the topics:

- Appearance, fate, transport and behaviour of pesticides and micropollutants related to the environment
- Monitoring of pesticide residues, metabolites and emerging contaminants in water, sediment, soil, air and biota
- Pesticide levels in food and food safety aspects

- New analytical techniques (green, micro, sensor-based methods, etc.) and strategies for the analysis of pesticides and related organic pollutants
- Recent advances in high-resolution mass spectrometry for the determination of environmental and food contaminants
- Environmental fate modelling
- Environmental protection and remediation techniques
- Technological advances for the elimination of pesticides and emerging pollutants
- (Eco)toxicity and environmental risk assessment
- Omic technologies for toxicological and environmental risk assessment
- Regulation and use of pesticides
- Importance of policies for the environment and food and feed safety

04/07/2022

2nd SIBECOL - AIL Meeting

Aveiro - Portugal

Participation of researchers from ICRA's Resources and Ecosystems Area in the conference Welcome to "Ecology: Bettering our sustainable future through scientific knowledge", an event joining the 2nd Meeting of the Iberian Ecological Society (SIBECOL), the XXI conference of the Iberian Association of Limnology (AIL), and the 21st National Congress of Ecology of the Portuguese Ecological Society – SPECO that will be held in Aveiro, Portugal in July 2022.

This "classical" in-person meeting aims to bring together the ecology community from Portugal, Spain, and further afield to exchange knowledge and expertise. Policymakers and environmental managers, industry members, and anyone else with an interest in ecological research and building an environmentally sustainable future are welcome to join us.

Today, more than ever, we feel there is an increasing need for ecologists to step in and help societal decision-making in regard to the current climate of overexploitation of natural resources, habitat loss and degradation, pollution, invasive species, urbanisation, climate change, and the overall global biodiversity crisis. The scientific knowledge that stems from ecological research has been vital to the establishment of socio-environmental connections and maintaining biodiversity and food production in cleaner environments, contributing to a more sustainable use and development of our natural capital.

Given the integrative and transdisciplinary aspects of ecological research, this meeting encourages contributions from researchers working on all sub-disciplines of ecology, ecosystems, and biological organisation levels. In this context, we hope to discuss theoretical and/or experimental approaches that can help us understand the complex interactions between organisms and their environment.

This is why we hope to come together to address one of the most pressing societal issues of our time: how to preserve our ecosystems in a functioning and resilient manner in the face of change.

Ensuring that all appropriate safety measures are in place, this meeting will also be an opportunity to get together with friends and colleagues, to cultivate diversity and inclusion, and to support and inspire students and young researchers within our community.



09/07/2022

Sergi Sabater, deputy director of ICRA, receives the AIL Lifetime Achievement Award in Limnology

Sergi Sabater, deputy director of the Catalan Institute for Water Research (ICRA), received the Iberian Association of Limnology (AIL) Award in recognition of his scientific career within the framework of the [SIBECOL AIL Meeting 2022](#), which was held from 3 to 8 July in Aveiro (Portugal). The Award is presented to an individual for their achievements in the field of Iberian limnology, including research, education, dissemination and transfer.

Under the motto "Ecology: Improving our sustainable future through scientific knowledge", the Congress is a joint event that comprises the II Meeting of the Iberian

Society of Ecology (SIBECOL), the XXI Congress of the Iberian Association of Limnology (AIL) and the 21st National Ecology Meeting of the Portuguese Society of Ecology (SPECO).

Sergi Sabater Cortés (1958) received his PhD in Biology from the University of Barcelona under the supervision of the eminent Prof. Ramon Margalef, who introduced him to limnology. Since then, his research has focused on the ecology of river ecosystems, especially the structure and ecological functions of primary producers and heterotrophs in the benthos and water column, the metabolism and functioning of rivers, and the effects of global change on freshwaters.

Sabater has co-published several books and published a large number of scientific articles on ecology and environmental sciences in influential international scientific journals. Dr Sabater has combined research with editorial commitments in scientific journals and teaching, first at the University of Barcelona and, since 2003, at the University of Girona, where he is a member of the Research Group on Continental Aquatic Ecology (GRECO) and the Institute of Aquatic Ecology.

In 2008, he was appointed deputy director of the Catalan Institute for Water Research by ICRA's Board of Trustees, and he is also a senior expert researcher on the ecology of river ecosystems, particularly on the role of biofilms, the metabolism and functioning of river systems, and the effects of global change on river systems.

At present, Sabater is focusing his research, as he explained at the conference, "on the effects of water scarcity and the impact of pollutants as concurrent stress factors that shape the current state of river ecosystems". After receiving the award, the professor read the paper "A Reflection for Science in Ecology. Does river flow show a path?" (Una reflexió per a la Ciència en Ecologia. El cabal del riu mostra un camí?).

Researchers from ICRA's [àrea de RiE](#) (Resources and Ecosystems) also participated in the conference through various workshops and lectures. The doctoral students, **Gabriela Córdoba** and **Dayana Jarma**, gave the lectures "Changes in the hydrological patterns of a highly stressed Mediterranean basin and their implications for water chemistry and primary production" and "How does this relationship vary in space and in relation to their gut bacterial communities?", respectively. How does this relationship vary in space and in relation to their gut bacterial communities?". Limnologist **Anna Freixa** spoke on "The relevance of wet events during dry periods on bacterial communities in temporary streams". In turn, the predoctoral researcher **Daniela Henry** presented "Carbon sequestration in reservoir sediments: understanding connections and potential impacts along the land-to-ocean continuum".

24/07/2022

ICRA RESEARCH: GiroNat. Turning to renaturation for a more resilient and healthy Girona

GiroNat is a shared, lasting and demonstrative city project that promotes biodiversity and green infrastructure as the backbone of a 180° turn towards urban renaturation, transforming Girona into a greener, more resilient and healthier city.

The project proposes an urban transformation that responds to Girona's challenges and opportunities as a Mediterranean, university and educational city that is socially diverse, river-based and in touch with nature (48% is in the Natura 2000 protected areas network).

GiroNat is divided into diagnostic and planning tasks, implementation tasks and follow-up work. Within this framework, ICRA will primarily be responsible for three tasks: (1) the modelling of urban drainage in the city of Girona to determine the most suitable places to implement sustainable urban drainage systems (SUDS), with the aim of reducing discharges into the unitary sewerage system and adopting a multifunctional perspective; (2) the scientific monitoring of a green wall for greywater treatment to be installed in the Sant Narcís Civic Centre, where the water will be reused to irrigate urban gardens in the same neighbourhood; (3) the development and implementation of indicators to measure the improvements in urban sustainability made during the project.

Lead Researcher: Dr. Lluís Corominas

Partners: GiroNat. Turning to renaturation for a more resilient and healthy Girona

Call: Grants to promote the renaturation and resilience of cities 2021 (financed by NextGeneration EU).

25/07/2022

Doctoral thesis defence, Danilo Bertagna

Danilo Bertagna was the first ITN NOWELTIES grantee to defend his PhD thesis, "UV-LED advanced oxidation processes for the efficient removal of organic micropollutants from water", on 21 July at the University of Zagreb.

The PhD supervisors were Sandra Babic from the University of Zagreb and **Gianluigi Buttiglieri** from ICRA-TiA. The thesis defence committee was composed of Dragana Mutavdzic, Marin Kovacic and Davor Ljubas from the University of Zagreb, María José Martín Sánchez from the University of Girona, and **Mira Petrovic**, head of the Water Quality Area at ICRA and coordinator of the ITN NOWELTIES project.

28/07/2022

ICRA secures nine positions for technical personnel through the INVESTIGO programme

The **Catalan Institute for Water Research (ICRA)** is offering nine technical staff positions (applicants under 30 years old) through the INVESTIGO Programme, funded by the European Union-Next Generation EU as part of the Recovery, Transformation and Resilience Plan.

01/08/2022

Adrián Jaén Gil, winner of the UdG's outstanding doctorate award 2021

Doctoral student **Adrián Jaén Gil** has won the outstanding doctorate award in Water Science and Technology with his thesis "Removal of pharmaceuticals in wastewater combining different treatment technologies: suspect screening identification and risk assessment of transformation products", supervised by **Sara Roz** and **Damià Barceló Culleres**, from ICRA, and tutored by **Manuela Hidalgo Muñoz**, from the UdG.

Adrián Jaén Gil will be publicly awarded the distinction during the Doctoral School's official inauguration of the 2022/2023 academic year, which will take place next November.

08/08/2022

ICRA researcher Wolfgang Gernjak contributes to two review papers on wastewater flow

ICRA researcher **Wolfgang Gernjak** has recently contributed to two ambitious review papers that aim to significantly advance their respective research fields. Mutzner et al, 2022, "A decade of monitoring micropollutants in urban wet-weather flows: What did we learn?" was recently published in Water Research (<https://doi.org/10.1016/j.watres.2022.118968>), while Hübner et al, 2022, "Emerging advanced oxidation processes for water and wastewater treatment—guidance for systematic future research" (<https://doi.org/10.31223/X5MH05>), was published as a preprint inviting comments from the research community.

16/08/2022

A team from ICRA's Water Quality Area collaborates with the La Sorellona Escanyagats Project

The team, formed by research staff from ICRA's **Water**

Quality Area (QA), Sara Rodríguez-Mozaz, Jose Castaño and Lucia Helena Santos, has collaborated for the second year running with the "Escanyagats Project" run by the environmental association "**La Sorellona**", which focuses on the study, conservation and dissemination of Mediterranean river habitats.

The work, which was made possible thanks to the support of the LLIBERA project (SEO Birdlife and Ecoembes), consisted of applying a simple methodology for the **sampling and analysis of microplastics (MPLs)** implemented the previous year in the River Celrà (Quart, province of Girona), to the River Onyar.

The results showed a moderate presence of MPLs in several sections of the river, especially in the centre of Girona (903 MPLs/m3), with a predominance of fragments (78 - 85%) over fibres (12 - 20%) and spheres (1 - 3%). The levels are similar or somewhat higher than those previously reported in the River Celrà, a tributary of the Onyar (Ter basin).

In parallel, the La Sorellona association evaluated the effectiveness of containment nets installed in several sewage and rainwater collectors to reduce the amount of urban waste reaching the River Onyar. Based on the rubbish that had accumulated in one of the containment nets (rainwater) over four months (1 kg), it is estimated that each net could prevent about 3 kg of waste/year/collector from reaching the river. Therefore, these types of preventive actions are important because the rubbish, which can potentially fragment into microplastics, can contribute to the degradation of aquatic ecosystems.

25/08/2022

A scientific expedition led by ICRA will study, for the first time, the destruction of the Aral Sea's carbon deposits

A scientific expedition led by the [Catalan Institute for Water Research \(ICRA\)](#) is studying the destruction of the carbon sink in the sediments of the Aral Sea (Kazakhstan), the world's largest dried-up lake, which has shrunk by around 90%, is regarded as one of the most devastating environmental disasters of the 20th century.

Lakes store large amounts of organic carbon in their sediments, which provide a fundamental ecosystem service to society: preventing the release of CO₂ into the atmosphere. However, when lakes dry out, the sediments come into contact with atmospheric oxygen, increasing the activity of micro-organisms that degrade organic matter. This causes the organic carbon trapped in the sediments to be released in the form of CO₂, destroying this carbon sink and contributing to climate change.

The aim of the **Alter-C** project, which is funded by the Spanish State Research Agency, is to understand how carbon deposits in lake sediments are released when

the lakes dry out. To this end, the team led by **ICRA** and made up of members from the French **CNRS Laboratoire des Sciences du Climat et de l'Environnement**, the **University of Málaga**, and the **University of Aarhus (Denmark)** is using state-of-the-art methodologies to measure gas emissions and carbon stocks.

Rafael Marcé, a researcher for **ICRA's Resources and Ecosystems Area**, explains that "understanding how the Aral Sea's carbon sink is being released into the atmosphere will allow us to estimate the effect of this process on atmospheric CO₂ concentrations on a global scale, and could become a compelling argument for the recovery of what was once the fourth largest lake on the planet".

The Alter-C expedition to the Aral Sea will take place over 20 days, from 26 August to 15 September, and "constitutes a major scientific milestone, as it is the first study of its kind to be carried out anywhere in the world," adds **Marcé**.

The research team will travel to Kazakhstan and, with logistical assistance from **Aral Tenizi**, an NGO dedicated to the recovery and protection of the Aral Sea, travel along the former lake bed, now a dry and inhospitable desert the size of Ireland, to collect evidence of the carbon sink's release. The expedition will have to cover hundreds of kilometres from the lake's former shore, which began to dry up in the 1970s, to its centre, which dried up during the last decade. During the journey, the researchers will collect sediment samples to measure the carbon released and measure CO₂ and methane emissions from the surface of the new desert.

The expedition members will be **Rafael Marcé** (ICRA), **Núria Catalán** (CNRS), **Enrique Moreno** and **Sofía Rodríguez** (University of Málaga), **Zhanna Tairova** (University of Aarhus) and **Makhambet Mukhtar** (Aral Tenizi).

The group will also be joined by the documentary filmmaker and biologist **Laura Carrau**, who has been involved in several previous scientific campaigns and will be responsible for recording images and audio-visual material. Laura's work will be used during the expedition to provide material to media channels that request it and, subsequently, to make a documentary about the scientific team's research in the Aral Sea.

01/09/2022

ICRA receives 1,376,650.92 euros from the Horizon Europe programme to initiate four projects in the field of water

Horizon Europe, the European Union's framework programme for research and innovation for the period 2021-2027, will allocate €1,376,650.92 to the **Catalan Institute for Water Research (ICRA)**. The funding will be distributed between four ICRA projects with a duration of between two and four years.

ICRA forms part of the Catalan Research Centres (CERCA), which is one of the ten best-funded institutions in the European programme, receiving 81 million euros and ranking in second place between the Centre national de la recherche scientifique (€149 M) and the Max Planck Society (€71 M). Horizon Europe promotes initiatives to combat climate change, contribute to achieving the UN Sustainable Development Goals and boost EU competitiveness and growth.

The ICRA projects awarded **Horizon Europe** funding are **SmartWaterTwin. Twinning For Smart Water-Thinking And Rethinking Wastewater Management In Circular Economy Frame**, with funding of 249,677.50 euros; **FOCUS4PFAS. Functionalised low-cost graphene sponge electrodes for sustainable water treatment - Elisabeth Cuervo**, with funding of 165,312.96 euros; **DEAR-Waste. Dynamics of communities and Evolution of Antibiotic Resistance in Wastewater-Marie Rescan**, with 181,152.96 euros, and **intoDBP. Innovative Tools To Control Organic Matter And Disinfection By-products In Drinking Water**, a coordinated project with a total budget of 3,994,707 euros, of which ICRA, the project's coordinator, receives 780,507.50 euros.

ICRA's projects: circular economy, health and sustainability in water management

Jelena Radjenovic, recently awarded the **2021 National Research Award in the Young Talent category**, is the lead researcher (LR) of SmartWaterTwin, one of the two projects initiated by ICRA on 1 September 2022. This project aims to contribute to "thinking and rethinking" **the circular economy in the water sector**. Its goal is to boost knowledge and research excellence in the field of sustainable wastewater treatment and management by increasing the scientific and technical capacities of enlargement institutions. It thus seeks to respond to a demand for innovative solutions from the water treatment sector in Serbia, which is currently inadequate even in the country's major cities (Belgrade, Novi Sad) and which will have to cope with unprecedented water demand due to the increasingly frequent and intense droughts in that part of Europe. The project, which falls within the framework of the Green Agenda for the Western Balkans, aims to change the perception of wastewater. The research for **SmartWaterTwin** will run until 31 August 2025.

The **DEAR-Waste** project, with **Carles Borrego** as lead researcher, also begins on 1 September. The objective of DEAR-Waste is to better understand the dynamics of bacterial communities in wastewater collectors with a particular focus on the evolution of antibiotic resistance, establishing these urban sinks as a model to study the dynamics and evolution of wastewater microbiota. The project takes an interdisciplinary approach (analytical chemistry, microbial ecology, environmental genomics, statistical time series analysis and modelling) to quantify how environmental complexity and species interactions in sewage modulate the evolution of antibiotic resistance. The project is scheduled to run until the end of August 2024.

The **intoDBP** project is scheduled to begin on 1 December this year and will run until the end of 2026. It has the largest financial allocation of the four projects. Directed and coordinated by **Maria José Farré**, it focuses on protecting water basins, the transformative treatment of drinking water and real-time monitoring to combat the effects of climate and global change. In particular, intoDBP focuses on the contamination and risks associated with disinfection by-products (DBPs) and will work on implementing and validating cross-cutting tools in four complementary case studies in three European countries (Spain, Cyprus and Ireland). Its intention is to encourage the rapid adoption of these tools on a European and global scale, thus strengthening Europe's position and role in the global water market. In addition, the project will engage society through surveys to analyse exposure to DBPs, collect data on water basin protection initiatives, and seek to raise awareness and promote sustainable consumer behaviour, such as reducing the consumption of bottled water.

The last of the ICRA projects to be funded by the Horizon Europe programme will start on 1 July 2023 and close in mid-2025. Named **FOCUS4PFAS** and also with **Jelena Radjenovic** as LR, it focuses on addressing the challenge of toxic, carcinogenic and bioaccumulative perfluoroalkyl substances (PFAS) in the water cycle. FOCUS4PFAS aims to develop low-cost graphene sponge electrodes tailored for efficient electrosorption/adsorption and the subsequent electrochemical degradation of PFASs. It will provide new opportunities for decentralised wastewater treatment, reuse and the control of contaminated waste streams at source.

09/09/2022

Participation in the PIAGri COST Action Workshop

At the recent **PIAGri COST Action** Workshop (Plasma Applications for Smart and Sustainable Agriculture), held in Slovakia between 8-9 September, ICRA researcher **Wolfgang Gernjak** chaired a session of working group IV, of which he is vice-chair. The session covered topics ranging from cold plasma water treatment to alternative approaches to manure management.

11/09/2022

IWA World Water Congress

ICRA researchers from the ANTARES project will participate in the [World Water Congress](#) organised by the International Water Association (IWA), which will take place in Copenhagen from 11 to 16 September. The event is the leading congress on issues related to the treatment and contamination of bodies of water and brings together more than 1,000 professionals, including researchers and companies.

ANTARES is a joint project run by the **University of Santiago de Compostela** and the **Catalan Institute for Water Research (ICRA)**. It is funded by the Spanish Ministry of Science and Innovation and focuses on using emerging technologies to transform and remove antibiotics from wastewater. The ICRA research team, led by **Dr Jelena Radjenovic** and **Dr Maite Pijuan**, is investigating the enhancement of the anaerobic degradation of persistent pollutants in the presence of biologically reduced graphene oxide (bioRGO).

12/09/2022

XXIX Conference of the Analytical Chemistry Division

Castello di Milazzo (Messina)

Analytical Chemistry for a green and sustainable future

On behalf of the Organising Committee, we are delighted to announce that the XXIX Conference of the Analytical Chemistry Division of the Italian Chemical Society (SCI) – Analytical Chemistry for a Green and Sustainable Future – will be held from Sunday 11 to Thursday 15 September 2022 at the Milazzo Castle (ME).

The Congress will open with a **Plenary Lecture from Prof. Damià Barceló (IDAEA-CSIC, ICRA - Catalan Institute for water research, Spain)** with the title **Microplastics in the aquatic environment: green**

analytical protocols, risks and sustainable solutions. It will include scientific sessions covering the main fields of research in analytical chemistry.

12/09/2022

EdiCitNet annual meeting held

The week of 5-9 September saw the annual meeting of the [EdiCitNet](#) project, in which ICRA participates as leader of Work Package 2. After two years of being held in a virtual format, this edition took place face-to-face in Ljubljana (Slovenia) with all the partners of the Edicitnet project present. During the week, the 30 project partners exchanged experiences in **urban agriculture and nature-based solutions for food production**, with a clear focus on reuse-oriented urban water, nutrient and waste management, thus favouring the transition towards more sustainable and resilient cities.

ICRA organised a workshop to **co-design the project platform**. A digital tool that will allow initiatives related to the urban food system to meet, exchange knowledge and learn from other initiatives. The idea is for the platform to integrate all the tools developed in the Edicitnet project, and ICRA will lead its design and development.

More information: <http://toolbox.edicitnet.com>

14/09/2022

ICRA seminar: Water quality monitoring using innovative technologies, Fiona Regan, Professor of Chemistry at Dublin City University and Director of the DCU Water Institute, 10 h, Conference Room - ICRA

Hello everyone. We are delighted to inform you that next Wednesday 14th we will be visited by Fiona Regan, Professor of Chemistry at Dublin City University and Director of the DCU Water Institute. She will be giving a short lecture about her Institute and Research: **Water quality monitoring using innovative technologies**.



16/09/2022

ICRA at the World Water Congress in Copenhagen

ICRA researchers **Oriol Casabella**, **Marc Castaño** and **Maite Pijuan** presented the results of the ANTARES project at the IWA World Water Congress (<https://worldwatercongress.org/>), which took place in Copenhagen from 11 to 16 September.

The congress brought together 4,000 professionals, including researchers and companies working on issues related to the treatment and pollution of water bodies.

18/09/2022

Gianluigi Buttiglieri participates in the final COST Action Circular City meeting

Gianluigi Buttiglieri, ICRA-TiA researcher, participated in the final meeting of the COST Circular City project (CA17133, Implementing nature-based solutions for creating a resourceful circular city) on 18 September in Aarhus (Denmark) and in the joint COST action and C2C-CC project workshop on 19 September in the same location.

19/09/2022

Gemma Geis, the Catalan Minister for Research and Universities, visits ICRA

The Catalan Minister for Research and Universities and Chair of the Board of Trustees of the Catalan Institute for Water Research Foundation (ICRA), **Gemma Geis**, paid an institutional visit to **ICRA's** headquarters in Girona on 16 September. During the visit, she learned about the research and innovation activity carried out at the centre from its management and researchers.

In addition, a meeting was held between Minister Gemma Geis, ICRA's management and research staff and members of the UdG. The meeting provided an opportunity to discuss the global challenges of efficiency and competitiveness in relation to the management of water resources in the Mediterranean and some of the centre's most emblematic projects, which aim to achieve sustainable water use through research and innovation.

The director of ICRA, **Damià Barceló**, expressed his intention to consolidate the Institute as a research centre of national and international reference and announced that ICRA would apply for recognition as a **Maria de Maeztu Unit of Excellence**, an accreditation that lasts for four years and represents an investment of five hundred thousand euros per year. The recognition would allow, according to Barceló, the implementation

of new policies to consolidate the scientific excellence of the Institute and increase its high-impact results. ICRA will also continue to apply for European projects. Indeed, this month, ICRA [received €1,376,650.92 from the Horizon Europe programme](#) to initiate four projects in the field of water. Damià Barceló also confirmed that one of his objectives is to **strengthen the research team** by incorporating new permanent researchers.

After the meeting, the Minister signed ICRA's Book of Honour and began a visit with the research staff to see projects and facilities such as the Pilot Plant Laboratory where wastewater treatment is carried out; the UdG-LEQUIA and ICRA collaboration in membrane recovery technology; the Mass Spectrometry Unit; the Biological and Molecular Techniques Unit, and the Mesocosmos, a pioneering scientific facility in Europe for experimental rivers that will help to improve the management of river basins. Also, during her visit, she had the opportunity to greet **Jelena Radjenovic**, the recent winner of the National Research Award in the Young Talent 2022 category.

Present during the visit from Minister Gemma Geis were the Rector of the University of Girona (UdG), **Quim Salvi**; the Director General of Research, **Joan Gómez**; the Vice-Rector for Research and Transfer of the UdG, **Maria Pla de Solà Morales**; the manager of the CACB and Chair of ICRA's Business and Social Council, **Jordi Agustí**; the Director of ICRA, **Damià Barceló**, and Deputy Director, **Sergi Sabater**; the Quality Area researcher, **Maria José Farré**; the Head of the Technology and Evaluation Area, **Maite Pijuan**; the Head of Resources and Ecosystems, **Vicenç Acuña**; the ICREA researcher in ICRA's Technology and Evaluation Area, **Jelena Radjenovic**, and ICRA's manager, **Ivan Sánchez**.

20/09/2022

ICRA hosts the first face-to-face meeting of the partners and members of the External Advisory Board of the PhageLand project

On 19 September, ICRA hosted the first face-to-face meeting of the partners and members of the External Advisory Board of the PhageLand project. The project aims to prevent the spread of antibiotic resistance in surface water.

In this context, the meeting was attended by researchers from the seven partners that are part of the project: University of Warsaw (Poland); Warsaw University of Life Sciences (Poland); KU Leuven (Belgium); Quadram Institute Biosciences (UK); Delft University of Technology (The Netherlands); Nicolae Testemitanu State University of Medicine and Pharmacy (Moldova) and ICRA.

The External Advisory Board members, Dr Karin Holmfeldt (Linnaeus University, Dept. Biology and Envi-

ronmental Science, Kalmar, Sweden); Prof. Ion Salaru, National Centre of Public Health (Moldova); Dr Antoni Munné, ECA (BCN); and Dr Lukasz Drewniak, University of Warsaw (Poland) also participated.

20/09/2022

WATER REUSE EUROPE CONFERENCE AND EXHIBITION ON INNOVATIONS IN WATER REUSE, GIRONA

20-21 SEPT 22 - The Palau de Congressos, Girona

Water Reuse Europe's Second Conference and Exhibition on Innovation in Water Reuse will take place in the historic and lively City of Girona on the 20th and 21st of September 2022. Only a 40-minute-long train journey from Barcelona, Girona is an excellent base for discovering Catalonia and its culture, its cuisine and the variety of its landscapes from the Costa Brava to the Pyrenees.

The conference will bring together professionals and organisations active in the water reuse sector for a two-day event packed with presentations from prestigious speakers, discussions, and technical visits. The conference will cover a wide range of topics, including water reuse for potable applications, public health protection in water reuse, industrial and decentralised water reuse, water reuse in urban environments, nature-based solutions for water reuse, and industrial reuse.

We therefore invite developers, industry leaders, solution providers, technology suppliers, policymakers, researchers, end-users, and consultants to share their experiences and perspectives on water reuse in Europe.

28/09/2022

Water: essential in our lives (Girona Researchers' Night Programme)

Girona, Casa de Cultura Auditorium, Thursday 28 September, at 10:00

European Researchers' Night is a public event dedicated to disseminating science. It aims to bring research, innovation and its protagonists to the public of all ages in a straightforward and enjoyable format.

The event takes place simultaneously every year in more than 300 cities across 30 European countries. During last year's event, more than 200 activities were organised in Catalonia, including talks, workshops, experiments, shows and games.

ICRA participates in the Research Night at the Campus Agua node: Water: essential in our lives, Girona [https://](https://lanitdelarecerca.cat/xerradaaigua/)

lanitdelarecerca.cat/xerradaaigua/

Water: essential in our lives!

Talk aimed at secondary school pupils - Registrations

We all know how essential water is for our lives. Climate change means that this resource is becoming increasingly scarce. In addition, water can be affected by contaminants, both from natural sources and human use. To ensure good water quality, we need tools to monitor that contamination. But not just to monitor it; data on contamination can also be used to extract information about our health.

Dr Claudia Fontàs, director of Campus Agua at the University of Girona and a professor in the Department of Chemistry, will explain the importance of the research in the field of water at the University of Girona (UdG) and discuss the UdG's research into designing pioneering systems for detecting pollutants in water.

Dr Lluís Coromines, a researcher at the Catalan Institute of Water Research (ICRA), will explain how chemical and microbiological analyses of wastewater can be used to extract health-related information. Covid is a very important case in point.

29/09/2022

Researchers' Night (microtalks)

18:30h CaixaForum building, Girona

With participation from ICRA researchers:

The water contamination crisis - what are we doing to mitigate it?

The talk will highlight the increase in contaminants of environmental concern, such as pharmaceuticals, pesticides and polyfluoroalkyl substances (PFAS) worldwide, as well as the presence of antibiotic-resistant bacteria and the actions that our research group (electron4water-ICRA) is taking to control and degrade these contaminants in different types of water. By **Dr Elisabeth Cuervo Lumbaque (Project electron4water/ICRA)**

The climate is changing, water too... and you, what would you change if you could see into the future?

In the face of evident climate change, the quantity and quality of the water in our rivers and lakes is also under threat. Many of these water resources are used to produce drinking water, making management and decision-making increasingly challenging for water companies. Thanks to advances in science and computing, we can now understand, represent and predict complex systems such as the climate, ecosystems and industrial processes. Using these predictive tools, we seek to estimate the future quality of water in reservoirs to support the drinking water

sector in preparing for significant changes in climate. And in doing so, ensure access to safe tap water for the whole population. By **Dr Àngela Pedregal Montes (Projecte inventWater/ICRA)**

07/10/2022

ICRA seminar: Mapping Ecosystem Services in Lakes. Dr Paulo Pereira, Mykolas Romeris University (Lithuania)

Conference room, H2O building - ICRA



Abstract: Freshwater ecosystems supply a wide range of regulating, provisioning and cultural ecosystem services (ES) and are key to human well-being. Lakes are one of the most important freshwater environments and are especially valuable in landlocked countries. Although this is recognised, these environments are subjected to multiple drivers of change (e.g., habitat, climate change, overexploitation, invasive species and pollution) that contribute substantially to the degradation of these environments and the ES supplied. To understand the capacity for lakes to supply ES, mapping is essential in identifying areas with a higher capacity that are subject to a higher threat. Most of the mapping studies were based on a qualitative approach (e.g., matrix), which has many limitations. In this talk, taking Lithuania (Figure 1), a country with more than 1000 lakes, we will map and assess several regulating, supporting and cultural ES supply and demand dimensions using a quantitative approach (e.g., field data, remote sensing).

10/10/2022

18th ANNUAL WORKSHOP ON EMERGING HIGH-RESOLUTION MASS SPECTROMETRY (HRMS) AND LC-MS/MS APPLICATIONS IN ENVIRONMENTAL ANALYSIS AND FOOD SAFETY

10-11 October, 2022-Barcelona, Spain

Workshop organised annually by IDAEA-CSIC and ICRA-CERCA

Following the success of the previous 17 International workshops on LC-MS/MS in environmental analysis and food safety (Barcelona 2005, Barcelona 2006, Guelph, Ontario 2007, Barcelona 2008, Toronto 2009, Barcelona 2010, Buffalo 2011, Barcelona 2012, Toronto 2013, Barcelona 2014, Burlington 2015, Barcelona 2014, Buffalo 2017, Barcelona 2018, Miami Beach 2019, Barcelona 2020-virtual and Ottawa-2021 virtual) we are delighted to announce the 18th International workshop on emerging high-resolution mass spectrometry (HRMS) and LC-MS/MS applications in environmental analysis and food safety. The workshop is expected to be held IN PERSON.

The main objective of the workshop is to evaluate practical aspects relating to the usefulness of high-resolution mass spectrometry and tandem mass spectrometric techniques for screening and quantifying organic contaminants in the environmental and food samples. The following practical aspects and state-of-the-art applications will be discussed:

- Advances in HRMS instrumentation and their applicability in environmental analysis and food authenticity
- Non-Target Analysis (NTA) and Bioinformatics applied to environmental and food samples
- Advanced Wastewater-Based Epidemiology (WBE) for public health
- Green Analytical Chemistry using HRMS and/or LC/MS-MS applied to environmental and food analysis
- Large number of applications in environmental analysis and food authenticity such as water and soil/sediment, biota and food, like fruits and vegetables, juices and meat

The workshop is intended to be an informal venue that encourages an exchange of the latest information and ideas among scientists from academia, government agencies and industry. Like last year, the workshop is a joint venture organised by IDAEA-CSIC (Barcelona, Spain) and ICRA – Catalan Institute for Water Research (Girona, Spain), in collaboration with the Spanish Society for Mass Spectrometry (SEEM).

A virtual special issue (VSI) in Methods Elsevier is planned. Authors wishing to submit a contribution to this VSI should contact the conference chair. The deadline for the submission of papers is 1 December 2022.

We look forward to seeing you on 10 – 11 October, 2022!

Damià Barceló ICRA-CERCA and IDAEA-CSIC, Girona and Barcelona, Spain, Chair of the Scientific Committee

10/10/2022

ESP Europe Conference

Heraklion, Greece, 10-14 October 2022

ICRA, together with the Institute of Environmental Planning of the University of Leibniz, is organising one of the sessions at the ESP Europe conference, the largest Europe-wide meeting on ecosystem services. The session delivered by ICRA focuses on the co-benefits of nature-based solutions for urban water cycle management.

More information: <https://www.esconference.org/europe22>

11/10/2022

Sustainability Fair 2022 and International Symposium on Sustainable Urban Environment (ISSUE-2022) Oct 11th-14th, 2022- Uttarakhand-India

ICRA will participate in the Sustainability Fair 2022 and International Symposium on Sustainable Urban Environment (ISSUE-2022), which will be held from the 11th to the 14th of October in Uttarakhand-India

Dr Damià Barceló has been invited to give three lectures in the plenary sessions.

- Lecture 1. Microplastics in the Aquatic Environment: Green Analytical Protocols, Risks and Sustainable Solutions
- Lecture 2. Fate, Risks and Remediation of Emerging Contaminants, Antibiotic Resistance Genes and Microplastics in Surface Waters and Groundwaters of Selected European Rivers and Future COVID-19- Related Challenges
- Lecture 3 .Assessing Water Treatment Technologies (Membrane, AOP, and Eco-friendly Fungal, and Microalgae) for Efficient Removal of Contaminants of Emerging Concern, ARG, Microplastics, and SARS-CoV-2 in Urban Wastewaters and Land-fill Leachates

Presentation:

Sustainability Cluster, SoE is organising the Sustainability Fair 2022 from Oct 11th-14th 2022. The theme of the fair is "Safe, Resilient, and Sustainable Cities & Communities." The Institute will host exhibitions by regional industries and organisations working on sustainable urban planning and industrial activities, green building materials, pollution, green energy, waste management and biorefinery, air pollution, and climate change. The fair aims to display cutting-edge research on sustainability and related challenges of high societal importance, promote cost-effective and sustainable solutions, and organise brainstorming sessions on

sustainable solutions through the industry-academia conclave/symposium to establish networking among various stakeholders. The participants include regional industries, research institutions, academia, government bodies, NGOs, and students. UPES will provide stalls to enable your organisation to exhibit your products, services, and cutting-edge research on sustainability and related challenges of high societal importance. The fee for an exhibition stall is INR 5000, but depending on the merit of the product/content, we are waiving this fee for selective organisations for a limited time period and on confirmation of your participation by 10 September 2022.

12/10/2022

The study of wastewater enables the detection and control of rodent infestations in cities

- Montserrat Carrascal, from the Spanish National Research Council (IIBB-CSIC): "The study of wastewater is a great source for detecting rodents in any city around the world or, if sampling is done at specific points in the sewage system, a rodent map can be created."
- The research was conducted within the framework of waterPRINT, a national project funded by the Ministry of Science and Innovation, which ICRA coordinates.

Barcelona has hosted the **18th Annual Workshop on High-Resolution Mass Spectrometry (HRMS) and Lc-Ms/Ms applications in environmental analysis and food safety**, organised by **CSIC and the Catalan Institute for Water Research (ICRA)**. A forum for debate that aimed to promote the exchange of information between scientists from the academic world, government agencies and industry.

Damià Barceló, director of ICRA and chair of the event's scientific committee, stated that "the presence in our country of a scientific gathering such as this one, attended by more than 130 experts from all over the world demonstrates, once again, the capacity of international leadership to attract and share new ideas and the latest advances in mass spectrometry".

One of the talks given was by Montserrat Carrascal, from the Spanish National Research Council (IIBB-CSIC), who stated that: "rodent infestations are a danger to human health due to the diseases they can transmit through the bacteria that infect them and the transmission of fleas, ticks and mites. They also compromise the integrity of infested structures and, once established, are very difficult to eliminate. In large cities, rats live in the sewers. If no control measures are taken, these rodents can live up to 7 years and breed up to 4 times a year with an average of 10-14 offspring, which means the numbers can vary rapidly in just a few months".

Today, various strategies are used to monitor these pests, generally based on animal counts and extrapolation to the total population. The number of animals in large cities is often reported as the number of rodents per inhabitant. For example, it's estimated that there may be one rat for every 4 inhabitants in Barcelona, and some estimates suggest as many as 10 rodents per inhabitant in New York. However, there is no standardised method for determining their numbers, estimating population density or understanding their population dynamics.

Surveillance of rodent infestations in wastewater using environmental proteomics

In a study led by Carrascal, from the Biological and Environmental Proteomics Group at the IIBB-CSIC in Barcelona, a strategy has been developed that uses wastewater to detect and quantify rodents based on the detection of rodent-specific proteins.

Like human faeces, rat faeces contain proteins secreted by the pancreas, which perform their function during food digestion and are subsequently eliminated. The detection of these enzymes, pancreatic amylases, in wastewater indicates the presence of live animals, and quantification relative to human amylase could help us to monitor the increase or decrease of rodent faeces in these samples.

Therefore, studying wastewater is a great way to detect rodents in any city around the world or, if the sampling is carried out at specific points in the sewage system, to create a rodent map. This work demonstrates the tool's potential to detect rodents using the water from our sewers.

The research has been carried out within the framework of the National waterPRINT Project funded by the Ministry of Science and Innovation, which ICRA coordinates.

The 18th Workshop On Emerging High-Resolution Mass Spectrometry (HRMS) and Lc-MS/Ms Applications in Environmental Analysis and Food Safety was organised with support from SCIEX, Agilent and Shimadzu as silver sponsors, ThermoFischer Scienti and Walters as bronze sponsors, and with the collaboration of Elsevier, WEC&N, Springer and King Saud University.

12/10/2022

Congress Water for the Common Good: Impact, Research and Challenges

(virtual) organised by the National Science and Technology Council (CONACIT) - Mexico

<https://congresodelagua.cimav.edu.mx/#speakers>

Roundtable with participation from ICRA.

9:00 AM

Macro- and Micro-Plastic Litter and Increased COVID-19-Based Plastic Pollution in the Aquatic Environment and Landfills: Risk Evaluation and Management Solutions

Moderator: Dr Luz Leal

Dr Damià Barceló, ICRA-CERCA

<https://congresodelagua.cimav.edu.mx>

17/10/2022

13th International Water Association Conference on Instrumentation, Control and Automation

Beijing

ICRA's Technology and Evaluation researcher, **Oriol Gutierrez**, will be the guest speaker at one of the main conference presentations at the 13th International Water Association Conference on Instrumentation, Control and Automation.

The conference aims to provide an international platform to exchange knowledge, methodologies and experiences relating to all aspects of sensor technology, instrumentation, control and automation in water and wastewater transport and treatment systems. Specific conference topics include sensors and instrumentation systems, online monitoring and control, modelling and simulation, early warning, information systems, decision support, risk assessment, big data, the Internet of Things and intelligent water systems.

In his presentation "Fostering digitalization in urban water systems with low-cost monitoring of combined sewer overflows and soft sensors", Oriol Gutierrez will explain ICRA's experiences in the field of sensors and their implementation in the process of digitising the urban water cycle.

The conference will take place in Beijing from 17-21 October 2022.

More information:

<https://www.iwa-ica2022.com/>

<https://iwa-network.org/>

18/10/2022

Hotel Samba in Lloret de Mar celebrates its tenth anniversary as an ICRA test laboratory dedicated to evaluating innovative water-saving technologies

- The research aims to ensure that tourism requires less drinking water, a scarce resource that is currently being wasted.
- The Catalan Institute for Water Research (ICRA) has implemented four projects to improve water management through more efficient technologies.
- The Hotel Samba in Lloret de Mar, where the research projects are being carried out, was already a European pioneer in sustainable practices.

In an increasingly tourism-oriented Mediterranean, improving water management is essential. Ten years ago, the [Catalan Institute for Water Research \(ICRA\)](#) launched a pioneering initiative to help improve water management in the tourism sector based on the idea that tourism can only continue to be one of the country's main economic drivers if it is sustainable.

Save water and save tourism

According to ICRA, the water consumed by a tourist is up to four times higher than that of a permanent resident, as indirect consumption is also taken into account: swimming pools, gardens, golf courses, spas, etc. Without a doubt, tourism in the Mediterranean puts a strain on water resources, especially in the summer months.

In an effort to help the tourist industry reduce its demand for drinking water, a scarce commodity, over the past ten years, ICRA has carried out a series of research projects on the ground, in real facilities that are open to the public. The hotel that decided to collaborate on the project was the **Samba**, a resort with a swimming pool built in 1972, with 433 rooms, a restaurant and 7,252 m² of green space. Located in Lloret de Mar, the three-star Hotel Samba had already been the first in Europe to obtain ISO 14001 (1997) and EMAS (1998) certificates for its best practices in water optimisation, automation of meters, LED lighting, recycling and recycling and waste management, among other sustainable habits.

A pioneering hotel in greywater separation

In fact, the hotel has had a greywater separation system in place since 1998. The water generated in baths and toilets is collected in a tank to be treated and reused in the toilet cisterns, reusing up to 15,000 m³ per year. This system is sustainable both ecologically (it reduces the demand for drinking water) and economically (it substantially reduces the water bill). The Hotel Samba was, therefore, already a local benchmark for sustainable water management in tourist accommodation. Even so,

the projects carried out by ICRA have shown that it's possible to go even further in terms of reusing water.

The four ICRA projects at the Hotel Samba

The first project to be implemented at the hotel was the **European EAUmed project**, [demEAUmed](#). Its goal was to create an optimal and safe closed water cycle using innovative integrated technologies. To achieve this, a **vertECO system** (from the Austrian company [Alchemia-nova](#)) was installed on the hotel's bar terrace.

This system, which is still installed at the hotel, consists of a wetland where different interactions occur between water, plants and the supporting medium. The **vertECO** wetland can purify greywater and has proven remarkably successful in treating it so that it can be **reused to irrigate the hotel's green areas or in the laundry**.

The three-year demEAUmed project, involving 15 partners from seven countries, combined eight leading technologies for the treatment and reuse of the different wastewater streams generated in the hotel (toilet flushing, laundry, showers, swimming pool, etc.), together with the **advanced monitoring of water quality and consumption parameters**.

The next research programme with the Samba Hotel was **CLEaN-TOUR**, a four-year national project to evaluate greywater treatment with **a combination of membrane systems and constructed wetlands**. In this instance, as well as including ornamental plants, **edible plants** were introduced. With this approach, in addition to treating greywater for reuse, the vegetables grown can be consumed on the hotel's premises. Another step towards increasing the circularity and sustainability of the tourist facility.

The third project ICRA participated in, running pilot tests at the Lloret de Mar hotel, was **SUGGEREIX**, promoted and financed primarily by the Catalan Water Agency (ACA) and led by the Eurecat technology centre. Its aim was to generate knowledge to improve water reuse management strategies.

Finally, ICRA's most recent project to be set in the Hotel Samba was **ReUseMP3**, funded by the Spanish State Research Agency and Ministry of Science and Innovation. The aim was to assess the feasibility of nature-based water treatment solutions so that water can be reused immediately. The project analyses the contaminants found in the water (pharmaceuticals, pesticides, microplastics, etc.). "It's important to assess both the efficiency of the solutions used and the impact that the organic micropollutants in the reused water have on the environment and human health", says **Gianluigi Buttiglieri**, an ICRA researcher working on circular economy issues and nature-based solutions.

The ICRA team involved in the different research projects at the Hotel Samba includes **Gianluigi Buttiglieri** and **Sara Rodriguez-Mozaz**, ICRA researchers specialising respectively in treatment and reuse technologies and

environmental chemistry; **Joaquim Comas**, tenured lecturer at the University of Girona, member of the LEQUIA research group and senior researcher attached to the Technologies and Evaluation Area of ICRA, **Esther Mendoza** and **Josephine Vosse**, predoctoral researchers at ICRA, and **Lucas Alonso**, postdoctoral researcher at ICRA, among other researchers.

Improving decision-making in water management

The results of the four ICRA research projects will be used to create decision-support tools that will promote water reuse in other Mediterranean tourism scenarios. This is essential if we are to achieve a more sustainable tourism sector with the responsible and efficient water management required in the current context of climate change and water scarcity.

According to **Esther Mendoza**, a predoctoral researcher at ICRA, whose doctoral thesis focuses on treating greywater with membrane systems and constructed wetlands: “there’s still a lot of work to be done, but thanks to the research and involvement of companies like Hotel Samba, we can contribute to a more sustainable tourism and promote practices that can be replicated in other Mediterranean tourism facilities”.

19/10/2022

Digital Water City interviews Oriol Gutierrez as part of the #SafeUrbanWater campaign

ICRA researcher **Oriol Gutierrez** became the first person to be interviewed by [Digital Water City](#) within the framework of the **#SafeUrbanWater** campaign.

In the interview, Gutierrez talks about his low-cost temperature sensor project for real-time combined sewer overflow (CSO) and flood monitoring and its potential for deployment in other cities.

You can find the interview in English at: <https://www.digital-water.city/news/diving-into-temperature-sensors-real-time-cso-flood-monitoring/>

04/11/2022

ICRA Director Damià Barceló and experts from around the world warn that the Russian-Ukrainian armed conflict makes progress towards the Sustainable Development Goals impossible

The Russian-Ukrainian armed conflict is a dramatic world event. Apart from the loss of life, the present conflict has tremendous impacts on the environment, economy, and society. The dispute has triggered a wave of events with global implications, especially for energy and food, with a worldwide recession and possible stagflation, the likes of which haven’t been seen since 1970. The escalation of this conflict is seriously threatening the prospects for achieving the United Nations (UN) Development Goals (SDGs), not just in the countries directly involved in the conflict but also in others, particularly those most vulnerable to the economic crisis.

A manifesto recently published as an editorial in the Geography and Sustainability journal under the title The Russian-Ukrainian armed conflict impact will push back the sustainable development goals, has been signed by six international experts, including Damià Barceló, director of ICRA-CERCA in Girona; Paulo Pereira, from Mykolas Romerios University, Vilnius, Lithuania; Wenwu Zhao, from Beijing Normal University; Lyudmyla Symochko, from Uzhhorod National University, Ukraine; Miguel Inacio, from Mykolas Romerios University, Vilnius, Lithuania, and Igor Bogunovic, from the Faculty of Agriculture at the University of Zagreb, Croatia.

Step by step, the experts analyse the impacts of the Russian-Ukrainian conflict on the biophysical, social and economic SDGs and the partnership needed to achieve the [UN’s goals](#).

The Russian-Ukrainian conflict’s impact on the SDGs varies. The biodiversity SDGs – land degradation, climate change, diversity loss – are strongly affected at the regional level (Russia, Ukraine, surrounding and EU countries). The social SDGs – poverty, loss of life, food, segregation, vulnerability, health – are affected at the local level (e.g. SDG 3 health and well-being; SDG 4 quality education) and at the global level (e.g. SDG 2 zero hunger).

Finally, the Russian-Ukrainian armed conflict has world-level implications for the economic SDGs – financial crisis, energy prices, unemployment, sanctions, inequality, inflation. The impacts of the ongoing conflict are growing in devastated cities, with destroyed water and sanitation infrastructure and rampant pollution from explosions within cities and forest fires. Uncertainties are multiplying in the Black Sea, for example, affecting Ukraine, Romania, Bulgaria, Turkey, Georgia and Russia, with more than 3,000 reported dead dolphins. If we are to achieve the UN’s

SDGs by 2030, peace is essential.

The UN SDGs (Sustainable Development Goals) were intended to define the fight for a better, more prosperous world for all, in which we can accept and live with one another’s differences. For many countries, COVID-19 slowed the progress towards achieving the targets by 2030. And the world was already struggling before the pandemic.

However, political disputes and armed conflicts constrain international coordination and cooperation for sustainable development.

In recent decades, the armed conflicts or wars in Libya, Iraq, Kosovo, Afghanistan, and other countries have significantly impacted regional and global development.

With the emergence of this conflict, several nations may find that achieving the SDGs by 2030 becomes unattainable.

The conflict slowed the post-COVID-19 recovery and negatively impacted the achievement of the regional and global SDGs. Many points in the article are based on new reports and, as such, are somewhat uncertain, which means the Russian-Ukrainian armed conflict’s impact on the SDGs is also uncertain.

However, there are direct effects that we already have to live with now and, maybe, for years into the future. Peace is the basis for sustainable development. Without peace, there will be no SDGs for 2030, or for the future. We need peace to safeguard the future of the planet.

08/11/2022

GUEST LECTURE: Fate, Risks and Remediation of Emerging Contaminants, Antibiotic Resistance Genes and Microplastics in Surface Waters and Groundwaters of Selected European Rivers and Future Covid-19 Related Challenges. Speaker: Prof. Damià Barceló Cullerès

18:30h Winstanley Lecture Theatre, Trinity College - Cambridge University

09/11/2022

webinar IWA The future of disinfection in drinking water & wastewater (London)

Source: International Water Association

<https://iwa-network.org/learn/the-future-of-disinfection-in-drinking-water-wastewater/>

Water professionals from academia, industry, water

utilities, and administration agencies, with particular focus on young water professionals

Description : This webinar is organised by the IWA Specialist Group (SG) on Disinfection. More information about this SG is available [here](#).

Disinfection is an essential procedure in drinking water and wastewater treatment and makes outstanding contribution to public health. Multiple disinfection technologies play an important role in the fight against epidemics and disease. Besides pathogen inactivation, disinfectants react with the natural or artificial organic matter in water, producing toxic disinfection by-products (DBPs).

So far, hundreds of DBPs have been identified and detected in drinking water and wastewater, and significant associations between DBPs and adverse health effects have been demonstrated. In continuity with the chapter related to disinfection and DBPs in the 3rd edition of the IWA Global Trend Report, recent challenges and opportunities emerging from the global scientific community and water industry will be presented in this webinar. The future vision on disinfection and DBPs will be discussed by three top-level scientists.

Learning Objectives

Following this session, participants will be able to:

Identify current main challenges and opportunities for disinfection and DBPs and related expected future development trends;

Identify main global stakeholders and their role in relation to the topic;

Identify different tools to deepen the specific knowledge about the topic.

Additional Resources

Publications

IWA Global Trends & Challenges Report

Webinar on-demand:

Wastewater Disinfection Modelling

Wastewater disinfection – the smart way

Webinar presentation slides: TBA.

Websites:

IWA Disinfection and DBPs 2022 Group

Host International Water Association

Panellists

- Chao Chen, Tsinghua University, China
- Haim Cikurel, EU Projects, Israel
- Andrea Turolla, Politecnico di Milano, Italy
- Gary L. Hunter, Black & Veatch’s Water Technology Group, USA
- Patrick Smeets, KWR Water Research Institute, Netherlands
- **Maria José Farré, Catalan Institute for Water Research ICRA, Spain**

15/11/2022

Two ICRA researchers among the top scientists in Spain according to the Research.com international ranking

- Damià Barceló, director of ICRA, and Mira Petrovic, head of ICRA's Water Quality and Safety Area, are ranked 4th in Spain. Barceló in the general ranking that classifies the best scientists in the world, and Petrovic in the specific category of best female scientists in the world.
- Ranking conducted by Research.com, the leading academic platform for researchers, after analysing the profiles of more than 166,000 scientists from all over the world.
- The Research.com 2022 list of the best female scientists in the world aims to give more visibility to the scientific achievements of women "although in the overall ranking by country, in which 7 Spanish scientists appear, it is significant that there are no women – regrets Damià Barceló. In this respect, we need to keep working to provide more equal opportunities for women in science".

For Mira Petrovic: "The low representation of women among the best scientists in Spain is worrying, but the situation is no better in other European countries (...) It's sad, but for every female scientist in the rankings, there are 10 male scientists", says the head of the ICRA's Water Quality and Safety Area.

Two researchers from the **Catalan Institute for Water Research (ICRA) have been ranked as the fourth-best scientists in Spain by Research.com**, the leading academic platform for researchers. Damià Barceló, director of ICRA, in the general ranking, which classifies the best scientists in the world, and **Mira Petrovic**, head of ICRA's Water Quality and Safety Area, in the specific category for the best female scientists in the world 2022.

More than 166,000 scientists' profiles were analysed to formulate a ranking according to the H-index metric provided by Microsoft Academic Graph. The results place ICRA as one of the institutions with the most researchers in the ranking's top echelons, reinforcing its position at the forefront of the Spanish scientific arena.

Damià Barceló, director of ICRA and researcher on environmental problems in the field of water quality

ICRA director Damià Barceló is ranked 4th in Spain and 419th in the world in a league table that provides an overview of the current research status of the leading scholars in his field. The ranking is regularly shared by leading universities around the world, such as MIT, Harvard, Oxford and Cambridge.

Barceló has been working in environmental chemistry for more than 40 years, and his efforts to address major problems in the field of water quality have been transcendent. His most significant work has been related to the development of methods to control the organic contamination caused by so-called "emerging pollutants" (polar pesticides, surfactants – detergents –, endocrine disruptors and pharmaceuticals, illicit drugs and carbon-based nanomaterials or fullerenes, in waste and natural waters).

Over the last ten years, his research has produced key international results that have provided valuable monitoring data for risk assessments of surface water, wastewater and groundwater, as well as advanced results in studies on the risk and remediation of emerging contaminants.

In addition, since 2010, he has been ranked among the most internationally cited scientists (ISI Highly Cited) due to the exceptional number and quality of his publications, with a Hirsch index of 141 (113), a total of over 92.7 thousand citations (> 62 k) and more than 1,380 publications (source Google Scholar on 07/10/2019, Scopus).

The full Research.com world ranking is available here: <https://research.com/scientists-rankings/best-scientists>

Mira Petrovic, researcher on the behaviour of emerging organic pollutants in wastewater and drinking water treatment

Mira Petrovic, head of the ICRA's Water Quality and Safety Area and ICREA researcher, is also ranked fourth in Spain and 433rd in the world in the ranking of top female researchers. The idea behind the ranking of female scientists is to provide further visibility for the scientific achievements of women and show that they deserve equal opportunities to be recognised and praised for their work.

An ICREA Research Professor, Petrovic holds a BSc in Chemical Engineering (1988), an MSc in Environmental Chemistry (1991) and a PhD in Chemical Sciences (1995) from the University of Zagreb, Croatia. Her primary field of research is the study of the fate and behaviour of emerging organic pollutants (pharmaceuticals and endocrine disruptors) in waste and drinking water treatment. The specific lines of research include the study of biotic and abiotic transformations of emerging contaminants, identification of transformation products, elucidation of transformation pathways, analysis of the presence and distribution of emerging contaminants in the aquatic environment and environmental risk assessment.

The research area led by Petrovic aims to provide a comprehensive and efficient response to problems and challenges relating to water quality, particularly in the Mediterranean region.

The full Research.com world ranking is available here:

<https://research.com/scientists-rankings/best-female-scientists>

Recognition for female scientists

As explained in the description of the world ranking of women scientists: "We are painfully aware that academic research remains a predominantly male profession (...). Our goal is to inspire women considering a scientific career and decision-makers around the world with an example of successful women in the scientific community".

Research.com hopes the ranking will give more visibility to the scientific achievements of women, "although in the overall ranking by country, in which 7 Spanish scientists appear, it is significant that there are no women", says the director of the ICRA. In this respect, we need to keep working to provide more equal opportunities for women in science".

For Mira Petrovic: "The low representation of women among the best scientists in Spain is worrying, but the situation is no better in other European countries. If we look at rankings, for example, in the field of Chemistry in Germany, the first woman appears in 43rd place, and in France and Belgium, there are no women in the first 15 positions. In Environmental Sciences, the situation is somewhat better, but there are only 1 to 3 women in the top 20 positions. In Spain, in both categories, I am the only woman in the top 15 (5 and 6, respectively). It's sad, but for every female scientist, 10 male scientists appear in the rankings," says the head of the ICRA's Water Quality and Safety Area.

About the Catalan Institute for Water Research (ICRA)

ICRA is a multidisciplinary water research centre created on 26 October 2006 by the government of the Generalitat de Catalunya. It is also a CERCA centre attached to the UdG and is supported by its patrons: the Ministry of Research and Universities, the Catalan Water Agency (ACA) and the University of Girona (UdG).

It is an international benchmark committed to conducting research on the complete water cycle, addressing topics such as water resources, water quality in the broadest sense of the word (chemical, microbiological, ecological, etc.), and treatment and evaluation technologies, and the transfer of this knowledge to society and the business and industrial fabric.

The research concerns all aspects of water, especially those relating to its proper use and the effects of human activity on water resources.

16/11/2022

International Congress on the Impacts of Climate Change on Agriculture, Ecosystems and Human Health (ICCC 2022)

16-18 November 2022, Miri, Malaysia

ICRA takes part in the International Congress on the Impacts of Climate Change on Agriculture, Ecosystems and Human Health (ICCC 2022). Dr Damià Barceló will participate as a speaker. <https://climateconf2021.com/keynote-speakers/>

Climate Change is the defining issue of our time and we are at a defining moment. From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale.

Without drastic action today, adapting to these impacts in the future will be more difficult and costlier.

Scientific Sessions

Sustainable Engineering and Technologies

Causes and Effects of Climate Change – Global Scenario
Green Technologies for the Adaptation and Mitigation of Climate Change

Changes in Biodiversity as an Impact of Climate change and Global warming

Effects of Global Warming and Climate change on Marine Life

Impacts of Global Warming and Climate Change on Human Health

Recent Trends in Biofuels, Bioenergy Production and Green

Initiatives: In an era of Climate Change and Global Warming

Energy and Environmental Policy for Climate Change Mitigation and Sustainability

Environmental Pollution – Causes and Consequences for Ecosystems

Carbon Cycle, CO2 Capture and Sequestration

Climate Change, Ecosystem Stability and Designer Ecosystems.

Recycle, Reduce and Reuse Environmentally-friendly Waste Products

Natural Hazards: Information and Communications Technology (ICT) and Weather Information Management

Earth Science and Climate Change: Law and Policies

Impacts of Climate change on International Trade, Commerce and Economics

Global Warming Effects on Agriculture, Forestry and Food Security

Impacts of Climate Change on Water Resources
 Climate Change Effects on Sea Ice and Glaciers
 Impacts of Climate Change on Livestock and Fisheries
 Recent Trends Climate-smart Agriculture (CSA)
 Precision Agriculture Technologies – Concepts and Issues
 Effect of Climate Change on Crop Pollination and Insect Pollinators
 Effects of Global Climate Change on Infectious Diseases
 Effects of Climate Change on Forced Migration, Human Security and International Law
 Implications of Climate Change on Small Island Developing States: Case Studies and Experiences
 Role of Non-governmental Organisations and Civil Societies in the Climate Change Negotiations
 Climate Change, Agriculturally Beneficial Soil Microbes and Sustainable Food Security for All
 Role of Mass Media in Climate Change Mitigation

28/11/2022

5th MS envi Day

28-29 November, Milan (Italy)

ICRA participation in the 5th MS EnviDay in Milan, organised by the Italian Chemical Society.

Guest lecture: Dr Damià Barceló: Wastewater-Based Epidemiology to Monitor COVID-19 Outbreak: Present and Future Diagnostic Methods to Identify Large Molecules Using Environmental Proteomics.

Environmental issues and pollution make headlines and are becoming increasingly important in everyday life. For good health and high quality of life it is important to monitor the source and extent of pollution and contamination, especially for compounds affecting human health.

The periodic updating of the list of substances to be monitored is made necessary by the continuous introduction of new synthetic molecules to the market, which requires the actors responsible for environmental control to respond promptly and flexibly to the challenges posed by emerging pollutants.

Mass Spectrometry (MS) is widely used in environmental analysis because of its ability to carry out robust, sensitive and quantitative analysis.

Because of the recent impressive developments, both regarding its coupling with separation techniques and rapid sampling and extraction methods, MS is actually a very powerful tool in the environmental field for detecting and quantifying micro-pollutants such as PAH, PCBs, dioxins, pesticides, PFOA, PFOS, endocrine disruptors and inorganic compounds.

The 5th MS EnviDay features plenary lectures and oral and poster communications to present the state-of-the-art applications of mass spectrometry in environmental analyses, as well as the latest technological developments, methodologies and applications in the environmental field.

The 5th MS EnviDay is a good opportunity to link industrial needs and academic knowledge and to promote meetings, discussions and cooperation on environmental sciences among scientists coming from public and private institutions, industries, and control and research institutes.

Topics include:

The new watch list: new emerging contaminants end limits

Analysis of soil and its contamination

Environmental pollutants (PFOA, PFAS, Chloroalkanes)

Micropollutants

Analysis of air, air pollutants, etc

Water, sediments and biota

Tap and surface water and its quality

Ambient mass spectrometry

High-resolution mass spectrometry

Targeted & non-targeted analysis

Microplastics

Validation of analytical methods in the environmental field

29/11/2022

The 3rd International Conference on Green Technology for Sustainable Environment 2022 (GTSE-2022)

27th November to 2nd December 2022, Taipei, Taiwan

The 3rd International Conference on Green Technology for Sustainable Environment 2022 (GTSE-2022) will be held onsite from 27th November to 2nd December 2022 in Taipei, Taiwan. GTSE 2022 aims to promote research in our field and facilitate the exchange of new ideas among academics, engineers, scientists, and practitioners. It includes plenary, keynote, and invited speeches, and oral & poster presentations. Best Presenter Awards and Best Poster Awards will be presented.

<https://www.gtse2022.com.tw/speakers>

With the participation of **Dr Damià Barceló** on the panel of guest speakers.

Plenary Speech Title: Wastewater-Based Epidemiology to Monitor COVID-19 Outbreak: Present and Future Diagnostic Methods to Identify Large Molecules Using

Environmental Proteomics.

30/11/2022

19TH JOINT CREAM-SCB-ICHN CONFERENCE – RESILIENCE IN THE FACE OF THE ENVIRONMENTAL CRISIS: ADAPTATION OR COLLAPSE? INSTITUTE OF CATALAN STUDIES Barcelona

CATALAN STUDIES Barcelona

We understand resilience as the capacity of a system to absorb changes and pressures from the environment while maintaining its characteristics and functioning. We speak of resilience to a traumatic shock – such as a natural catastrophe or an economic crisis – as the capacity to return to the previous situation. We also use this word when we refer to the capacity to adapt to a profound transformation of the environment – such as climate change – or of the social context – such as the changes brought about by COVID-19.

Finally, we say that a system is resilient if it is able to avoid collapse and maintain its main characteristics without abruptly transforming into a different system.

In the face of the environmental crisis, what capacity do we have to preserve the services provided by ecosystems? Is our socio-ecological system resilient? This session brings together people from different disciplines to explain the application of the concept of resilience, illustrated through examples of success or failure, in the maintenance of different socio-ecological systems when faced with profound impacts on the environment. The goal is to create a common framework for understanding the phenomenon of resilience that will allow us to identify ways to promote it, given the enormous environmental challenge we are facing.

Activity conducted as part of the RESONATE project (Resilient forest value chains - enhancing resilience through natural and socio-economic responses).

PROGRAMME

09:00 WELCOME

Joan Pino, Director of CREAM, Jordina Belmonte, President of ICHN, Marc Martí, President of SCB

09:15 What is resilience and how can we measure it? Francisco Lloret, CREAM and the Autonomous University of Barcelona (UAB)

10:00 Resilient soils as agents of adaptation to environmental changes Rosa Poch, Rosa Poch, University of Lleida (UdL)

10:25 Pests and droughts. How do forests resist this lethal combination? Luciana Jaime, CREAM

11:25 Forest fires as an example of socio-natural risk: how to address the socio-ecological resilience of the

territory? Eduard Plana, Catalan Centre for Forestry Science and Technology (CTFC)

11:50 Mediterranean rivers, an example of resilience? Sergi Sabater, University of Girona (UdG), Catalan Institute for Water Research (ICRA)

12:15 Marine reserves and resilience in Mediterranean marine systems Toni Grau, Marine Resources Service of the Government of the Balearic Islands. Natural History Society of the Balearic Islands

12:40 Resilience and collapse in socio-ecological systems: the case of the Mar Menor Julia Martínez, Fundación Nueva Cultura del Agua

14:45 Knowledge, common sense and sobriety: tools for adapting food sovereignty in times of uncertainty, Robert Savé, Institute of Agri-Food Research and Technology (IRTA)

15:10 Urban resilience and human health; the urban burden of disease project, Mark J. Nieuwenhuijsen, Institute for Global Health (ISGlobal)

15:35 Zoonotic disease surveillance with a One Health approach, Núria Busquets, Centre for Research in Animal Health (CRESA)

16:00 **ROUNDTABLE AND CONCLUSIONS:** How can we promote resilience to environmental crises?

30/11/2022

ICRA headquarters hosts the fifth meeting of the iWAYS project

The partners of the iWAYS project - Innovative Water recoveryY Solutions through recycling of heat, materials and water across multiple sectors - held their fifth meeting this November at the headquarters of the **Catalan Institute for Water Research (ICRA)**. The project is funded by the European Union's H2020 programme under the SPIRE initiative.

Representatives of the 19 iWAYS partners met to share the latest developments related to all aspects of a project that aims to deliver a set of technologies and systems for industrial processes to recover water and heat, and in some cases, materials, from exhaust streams, thereby reducing resource consumption and increasing energy efficiency.

The four-year-long project has just reached the halfway point, with most of the groundwork completed, and the iWAYS solutions will now be made available to industry partners over the coming months. For more information, please consult the project's web page: www.iways.eu



02/12/2022

Launch of the European intoDBP project, led by ICRA

On 1 December, the **European intoDBP project** got underway, led by the **Catalan Institute for Water Research (ICRA)**, which will coordinate a team made up of 15 partners from Spain, Ireland, Cyprus, Italy, Belgium, Israel, Austria, the USA and Australia over a four-year period. The ICRA team will comprise researchers **Maria Jose Farré (LR)**, **Rafa Marcé**, **Mira Petrovic**, **Wolfgang Gernjak** and **Sara Rodríguez**.

The intoDBP project aims to create innovative tools and strategies to improve water quality management for safe human use and a healthy environment. The project focuses on catchment protection and forecasting, advanced drinking water treatment and real-time monitoring to combat the effects of climate and global change.

Innovative tools for controlling the organic matter and disinfection by-products in drinking water

In particular, intoDBP focuses on the contamination and risks associated with disinfection by-products (DBPs). Through the development and application of advanced, integrated and cost-effective sensors and analytical methods, intoDBP will expand knowledge on water quality and DBP precursors to better understand their formation and human exposure in Europe. The intoDBP monitoring results will be fed into numerical forecasting tools to predict water changes in the catchment and formulate climate change adaptation pathways at the catchment and treatment scale. IntoDBP also develops transformative technology for upgrading water treatment and disinfection.

In the intoDBP consortium, researchers, small and large companies, and experts in communication and public services come together to develop interdisciplinary solutions, which will generate a renewed perspective on drinking water monitoring, support decision-

making and governance and increase system resilience. intoDBP will implement and validate its cross-cutting products in four complementary case studies in three European countries where compliance with DBP regulation is currently a recognised challenge. The direct and visible positive impact of intoDBP on the case studies will encourage rapid product adoption at a European and global level, thus strengthening Europe's position and role in the global water market.

07/12/2022

GUEST LECTURE Fate, Risks and Remediation of Emerging Contaminants, Antibiotic Resistance Genes and Microplastics in Surface Waters and Groundwaters of Selected European Rivers and Future Covid-19 Related Challenges. Speaker: Prof. Damià Barceló Cullerès

Department of Civil, Environmental and Geomatic Engineering, University College London

10/12/2022

International speeches by ICRA's director in London, Milan, Miri and Taipei on using wastewater-based epidemiology to monitor the COVID-19 outbreak

Over the last few months, the director of ICRA, Damià Barceló, has attended several international conferences to give talks on using wastewater-based epidemiology to monitor the COVID-19 outbreak.

Specifically, he spoke at the International Congress on Impacts of Climate Change on Agriculture, Ecosystems and Human Health (Mire, Malaysia) on the results of the #GLOBAQUA project and the need for advanced water treatment solutions.

Subsequently, he participated in the 5th #EnviDay congress in Milan, organised by the Italian Chemical Society and in the 3rd International Conference on Green Technology for Sustainable Environment 2022 (Taipei, Taiwan).

Lastly, he was the keynote speaker at a conference at University College London on "Fate, risks and remediation of emerging contaminants, antibiotic-resistance genes and microplastics in the surface and groundwater of selected European rivers and future challenges related to COVID-19".

21/12/2022

Creation of Ecomemb, the first spin-off to have participation from ICRA

Ecomemb was created for the sustainable regeneration of reverse osmosis membranes by the **LEQUIA** research group at the **Universitat de Girona (UdG)** and **ICRA**

By 2025, more than 1.5 million reverse osmosis membranes, equivalent to 25,500 tonnes of plastic, will be thrown into landfills every year. To overcome this problem, and as an alternative to rejecting these filters, the **LEQUIA** research group at the **Universitat de Girona (UdG)** and the **Catalan Institute for Water Research (ICRA)** have created **Ecomemb**, a new spin-off designed to renew and recycle reverse osmosis membranes sustainably. These filters are found in the technology most commonly used worldwide to desalinate water for consumption.

The constitution and creation of the company took place today at UdG's Science and Technology Park in the presence of the rector, Quim Salvi; the director of ICRA, Damià Barceló; and also the partners and founders of Ecomemb, Raquel García Pacheco, Joaquín Comas, Ignacio Rodríguez-Roda, Héctor Monclús, Albert Galizia and Enric Monturiol.

The new spin-off will begin trading, having optimally and sustainably implemented and tested more than 300 Ecomemb® membranes in ten Spanish industrial facilities involved in treating landfill leachate, secondary effluents from urban wastewater, condensate water and brackish water. Initially, the company plans to operate in Spain and the rest of Europe, the Middle East and North Africa, with an estimated target market value of 100 million euros per year.

"Our goal is to become a global benchmark in the sustainable management of reverse osmosis membranes used in desalination and other industries and to promote a circular management model that prevents the disposal of membranes that still have a useful life," says **Raquel García Pacheco**, CEO and co-founder of Ecomemb.

Thus, the new company will market a **sustainable and patented technology that optimises the process of renewing and reconditioning reverse osmosis membranes**. In doing so, Ecomemb will help companies and customers to align themselves with the circular economy and the Sustainable Development Goals (SDGs), specifically goals 12 and 13, which call, respectively, for sustainable consumption and production patterns and taking urgent action to combat climate change and its effects.

In numbers, the use of Ecomemb® membranes saves up to 60% in membrane replacement costs, uses less energy for filtration with the same water quality

standards, prolongs membrane lifetime by at least 50%, saves 85.5 kg of CO₂ and 12 kg of plastics per rejected membrane.

Ecomemb starts its entrepreneurial journey with the Ship2b seal for companies that provide environmental benefits, awarded by the Ship2b Foundation, and as a finalist in the EAE Business School's **Impact Forest Awards (2022)** as well as in **Barcelona Activa's pre-acceleration programme (2022)**.



10

□ Awards

- Dr Radjenovic was awarded the prestigious 2022 FCRI National Young Talent Research Award in 2021, the top research award in Catalonia (Catalonia receives >40% of ERC grants in Spain).
- The work "Contaminants of Emerging Concern in Algae-Based Treatment". Prosenc, F., Škufca, D., Heath, E., Buttiglieri, G., Istenič, D., Griessler Bulc, T. was selected for excellent achievement in science 2022 by the Slovenian Research Agency.





11

Financing

Contribution of the Regional Government of Catalonia

Ministry of Research and Universities - Gencat (Trustee)	€ 2,030,953.00
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Catalan Water Agency (ACA) (Trustee)	€ 600,000.00
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Competitive projects

Regional Government of Catalonia	€ 343,281.30
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Spanish Ministry	€ 670,796.30
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European Union	€ 1,380,523.38
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Transfer projects

Knowledge Transfer Technology (KTT)	€ 650.882,38
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Financial income	€ 0
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Other income	€ 6,734.16
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TOTAL INCOME	€ 5,683,170.52
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As an ICRA Trustee, the **University of Girona** annually consolidates its non-monetary contribution to ICRA from the transfer of the researchers assigned to its investigations, which was financially valued by the UdG in the amount of €199,492.52 for 2022.

12

□ ICRA in the news & press

The issuing of press releases on work carried out by the scientific community stabilised after the pandemic, and in 2022, a total of 13 press releases were issued in two languages: Catalan and Spanish.



PRESS RELEASES

Press releases were issued on the following topics:

10/03/2022

L'ICRA se suma al Dia Mundial de l'Aigua posant en valor les aigües subterrànies

<https://press.clipmedia.cat/notas/licra-se-suma-al-dia-mundial-de-laigua-posant-en-valor-les-aigues-subterrànies/>

El ICRA se suma al Día Mundial del Agua poniendo en valor las aguas subterráneas

<https://press.clipmedia.cat/notas/licra-se-suma-al-dia-mundial-de-laigua-posant-en-valor-les-aigues-subterrànies/>



04/05/2022

ICRA patrocina el Print of Science Festival a Girona

<https://press.clipmedia.cat/notas/icra-patrocina-el-print-of-science-festival-a-girona/>

ICRA patrocina el Print of Science Festival en Girona

<https://press.clipmedia.cat/notas/icra-patrocina-el-print-of-science-festival-a-girona/>



06/05/2022

El Dr. Damià Barceló rep el Doctorat Honoris Causa de la Universitat d'Almeria després de 30 anys de col·laboració

<https://press.clipmedia.cat/notas/el-dr-damia-barcelo-rep-el-doctorat-honoris-causa-de-la-universitat-dalmeria-despres-de-30-anys-de-col%2b7laboracio/>

El dr. Damià Barceló recibe al Doctorado Honoris Causa de la Universidad de Almería después de 30 años de colaboración

<https://press.clipmedia.cat/notas/el-dr-damia-barcelo-rep-el-doctorat-honoris-causa-de-la-universitat-dalmeria-despres-de-30-anys-de-col%2b7laboracio/>



06/06/2022

L'ICRA patenta una nova tecnologia amb esponges de grafè que elimina els contaminants persistents de l'aigua a baix cost i sense productes químics

<https://press.clipmedia.cat/notas/licra-patenta-una-nova-tecnologia-amb-esponges-de-grafe-que-elimina-els-contaminants-persistents-de-laigua-a-baix-cost-i-sense-productes-quimics/>

El ICRA patenta una nueva tecnología con esponjas de grafeno que elimina los contaminantes persistentes del agua a bajo coste y sin productos químicos

<https://press.clipmedia.cat/notas/el-icra-patenta-una-nueva-tecnologia-con-esponjas-de-grafeno-que-elimina-los-contaminantes-persistentes-del-agua-a-bajo-coste-y-sin-productos-quimicos/>

16/06/2022

ICRA assenyala el valor de les aigües subterrànies per combatre la sequera, en el Dia Mundial contra la Desertificació

<https://press.clipmedia.cat/notas/icra-assenyala-el-valor-de-les-aigues-subterrànies-per-combatre-la-sequera-en-el-dia-mundial-contra-la-desertificacio/>

ICRA señala el valor de las aguas subterráneas para combatir la sequía, en el Día Mundial contra la Desertificación

<https://press.clipmedia.cat/notas/icra-senala-el-valor-de-las-aguas-subterraneas-para-combatir-la-sequia-en-el-dia-mundial-contra-la-desertificacion/>

07/07/2022

Sergi Sabater, sotsdirector de l'ICRA, recull el Premi a la Trayectoria en Limnologia de l'AIL

<https://press.clipmedia.cat/notas/sergi-sabater-sotsdirector-de-licra-recull-el-premi-a-la-trayectoria-en-limnologia-de-lail/>

Sergi Sabater, sotsdirector de l'ICRA, recull el Premi a la Trayectoria en Limnologia de l'AIL

<https://press.clipmedia.cat/notas/sergi-sabater-sotsdirector-del-icra-recoge-el-premio-a-la-trayectoria-en-limnologia-del-ail/>

25/08/2022

Una expedició científica dirigida per l'ICRA estudiarà per primer cop la destrucció dels dipòsits de carboni del Mar d'Aral

<https://press.clipmedia.cat/notas/una-expedicio-cientifica-dirigida-per-licra-estudiara-per-primer-cop-la-destruccio-dels-diposits-de-carboni-del-mar-daral/>

Una expedición científica dirigida por el ICRA estudiará por primera vez la destrucción de los depósitos de carbono del Mar de Aral

<https://press.clipmedia.cat/notas/una-expedicion-cientifica-dirigida-por-el-icra-estudiara-por-primera-vez-la-destruccion-de-los-depositos-de-carbono-del-mar-de-aral/>



01/09/2022

L'ICRA rep 1.376.650,92 € del programa Horizon Europe per iniciar quatre projectes en l'àmbit de l'aigua

<https://press.clipmedia.cat/notas/licra-rep-1-376-65092-e-del-programa-horizon-europe-per-iniciar-quatre-projectes-en-lambit-de-laigua/>

El ICRA recibe 1.376.650,92 € del programa Horizon Europe para iniciar cuatro proyectos en el ámbito del agua

<https://press.clipmedia.cat/notas/el-icra-recibe-1-376-65092-e-del-programa-horizon-europe-para-iniciar-cuatro-projectos-en-el-ambito-del-agua/>



16/09/2022

Gemma Geis, consellera de Recerca i Universitats, visita l'ICRA

<https://press.clipmedia.cat/notas/gemma-geis-consellera-de-recerca-i-universitats-visita-licra/>



10/10/2022

L'estudi de les aigües residuals permet detectar i controlar les plagues de rosegadors a les ciutats

<https://press.clipmedia.cat/notas/lestudi-de-les-aigues-residuals-permet-detectar-i-controlar-les-plagues-de-rosegadors-a-les-ciutats/>

El estudio de las aguas residuales permite detectar y controlar las plagas de roedores en las ciudades

<https://press.clipmedia.cat/notas/el-estudio-de-las-aguas-residuales-permite-detectar-y-controlar-las-plagas-de-roedores-en-las-ciudades/>



18/10/2022

L'Hotel Samba de Lloret de Mar compleix deu anys com a laboratori de proves de l'ICRA, dedicat a avaluar tecnologies innovadores d'estalvi d'aigua

<https://press.clipmedia.cat/notas/lhotel-samba-de-lloret-de-mar-compleix-deu-anys-com-a-laboratori-de-proves-de-licra-dedicat-a-avaluar-tecnologies-innovadores-destalvi-daigua/>

El Hotel Samba de Lloret de Mar cumple diez años como laboratorio de pruebas del ICRA, dedicado a evaluar tecnologías innovadoras de ahorro de agua

<https://press.clipmedia.cat/notas/el-hotel-samba-de-lloret-de-mar-cumple-diez-anos-como-laboratorio-de-pruebas-del-icra-dedicado-a-avaluar-tecnologias-innovadoras-de-ahorro-de-agua/>



04/11/2022

Experts d'arreu del món adverteixen que el conflicte armat rusoucrainès impossibilita avançar cap als Objectius de Desenvolupament Sostenible

<https://press.clipmedia.cat/notas/experts-darreu-del-mon-adverteixen-que-el-conflicte-armat-russoucraines-impossibilita-avancar-cap-als-objectius-de-desenvolupament-sostenible/>

Expertos de todo el mundo advierten que el conflicto armado ruso-ucraniano imposibilita avanzar hacia los Objetivos de Desarrollo Sostenible

<https://press.clipmedia.cat/notas/expertos-de-todo-el-mundo-advierten-que-el-conflicto-armado-ruso-ucraniano-imposibilita-avanzar-hacia-los-objetivos-de-desarrollo-sostenible/>



15/11/2022

Dos investigadores de l'ICRA, entre els primers científics d'Espanya segons el ranking internacional Research.com

<https://press.clipmedia.cat/notas/dos-investigadors-de-licra-entre-els-primers-cientifics-despanya-segons-el-ranking-internacional-research-com/>

Dos investigadores del ICRA, entre los primeros científicos de España según el ranking internacional Research.com

<https://press.clipmedia.cat/notas/dos-investigadores-del-icra-entre-los-primeros-cientificos-de-espana-segun-el-ranking-internacional-research-com/>



225 media impacts were achieved: 198 in digital media, 19 in the written press, 4 on television and 4 on radio. In this sense, the engagement and availability of the ICRA researchers was fundamental when it came to managing the requests for collaboration, interviews and statements made by the media.

In 2022, ICRA also continued its commitment to outreach through social media channels. A total of 384 tweets were published from the Twitter account @Icrawater, whose content achieved a total of 114,050 impressions, 4403 interactions, 1861 mentions and 805 clicks on the profile. The number of followers increased by 374 to 2547 in December 2022.

On Instagram, 43 posts (compared to the 4 posts published in 2021), 14 stories and 1 reel were published, with the content achieving a total of 20,890 impressions, 1410 interactions, 1375 likes and 1008 profile views. The number of followers reached 502 in December 2022.

A total of 11 publications were made on LinkedIn, and their content achieved a total of 21340 impressions, 3524 interactions and 3172 clicks. The number of followers increased to 2914 in December 2022.

In addition, 5 videos about ICRA's services and activities were published on ICRA's YouTube channel in two languages: Catalan and/or Spanish. These videos achieved 781 views. In December 2022, the channel had 32 subscribers.

During 2022, the ICRA News electronic newsletter, a tool that aims to publicise the activities and research carried out at ICRA, continued to be published quarterly and in three languages: Catalan, Spanish and English.

A total of 62 news items were published on the ICRA website, also in three languages.



Girona



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