AIL
Asociación Ibérica de Limnología

URA
NATURA
KULTURA

XXIII Congreso de la Asociación Ibérica de Limnología

Bilbao, 22-26 de junio de 2026

XXIII Congresso da Associação Ibérica de Limnologia

Bilbao, 22-26 de Junho de 2026

XXIII Meeting of the Iberian Limnological Association

Bilbao, 22-26 of June 2026

Entidades organizadoras:

EHU · Zientzia eta Teknologia Fakultatea / Facultad de Ciencia y Tecnología · 50 urte / años 1968-2018 · Bizkaia Zientzia! Ciencia Viva

U I K

Evento sostenible gracias a:

Eusko Jaurlaritza Gobierno Vasco · ura ur agentzia · Bizkaia foru aldundia diputación foral · Donostia San Sebastián · Bilbao Bizkaia Ur Partzuergoa Consorcio de Aguas Bilbao Bizkaia

Erronka Garbia Ekitaldi Evento · Jasangarria ingurumenerako ambientalmente sostenible

anbiotek · ekolur · eurofins Environment Testing · AECOM

COMITÉ ORGANIZADOR · COMISSÃO ORGANIZADORA · ORGANIZING COMMITTEE

Arturo Elosegi *(Presidente · Presidente · President)*
Maite Arroita *(Secretaria · Secretária · Secretary)*
Aitor Larrañaga *(Tesorero · Tesoureiro · Treasurer)*
Idoia Biurrun
Luz Boyero
Leire Méndez
Sergio Seoane

COMITÉ CIENTÍFICO · COMISSÃO CIENTÍFICA · SCIENTIFIC COMMITTEE

Romina Alvarez Troncoso *(Universidade de Vigo)*
Pepe Barquín Ortíz *(Universidad de Cantabria)*
Jhon Donato-Rondón *(Universidad Nacional Colombia)*
Andrea C. Encalada *(Universidad de San Francisco de Quito)*
Claudia Feijoó *(Universidad Nacional de Luján)*
Verónica Ferreira *(Universidade de Coimbra)*
Anna Freixa *(Institut Català de Recerca de l'Aigua (ICRA))*
Rosa Gómez Cerezo *(Universidad de Murcia)*
Vítor M. Costa Gonçalves *(Universidade dos Açores)*
Cayetano Gutiérrez Cánovas *(Universidad Rey Juan Carlos)*
Cláudia Pascoal *(Universidade do Minho)*
João Pestana *(Universidade de Aveiro)*
Andreu Rico *(Universitat de València)*

CONFERENCIAS PLENARIAS · CONFERÊNCIAS PLENÁRIAS · PLENARY LECTURES

Francisco J. Oficialdegui

Estación Biológica de Doñana (EBD–CSIC). España / Spain.

"Retos y prioridades en la gestión de especies invasoras acuáticas"

[ES] El Dr. Francisco J. Oficialdegui es doctor en Biología por la Universidad de Sevilla y realizó su tesis en la Estación Biológica de Doñana (EBD-CSIC). Durante su etapa postdoctoral trabajó en diversas instituciones españolas y en universidades de los Países Bajos y la República Checa, y ha realizado consultoría para empresas y organismos internacionales como la Comisión Europea y la UICN. Actualmente es investigador postdoctoral en la EBD-CSIC mediante un contrato competitivo de la Junta de Andalucía. Su investigación se centra en las invasiones biológicas de agua dulce, integrando enfoques ecológicos, moleculares y socioeconómicos. Utiliza principalmente los cangrejos de río como modelo para analizar vías y rutas de introducción desde perspectivas históricas, sociales y moleculares, evaluar impactos ecológicos y socioeconómicos, estudiar la dinámica de enfermedades acuáticas y sus consecuencias para la biodiversidad, y desarrollar herramientas aplicadas a la gestión y la toma de decisiones. Sus líneas actuales incluyen la priorización en la gestión de especies invasoras y el estudio de aquellas con valor comercial, dada su estrecha interrelación ecológica, económica y social.

[PT] O Dr. Francisco J. Oficialdegui é doutorado em Biologia pela Universidade de Sevilha e realizou a sua tese de doutoramento na Estação Biológica de Doñana (EBD–CSIC). Durante o pós-doutoramento, trabalhou em várias instituições espanholas e em universidades dos Países Baixos e da República Checa, tendo também realizado consultoria para empresas e organismos internacionais como a Comissão Europeia e a UICN. Atualmente, é investigador de pós-doutoramento na EBD–CSIC com um contrato competitivo da Junta de Andaluzia. A sua investigação centra-se nas invasões biológicas em águas doces, integrando abordagens ecológicas, moleculares e socioeconómicas. Utiliza principalmente os lagostins de rio como modelo de estudo para analisar vias e rotas de introdução em perspetivas históricas, sociais e moleculares; avaliar impactos ecológicos e socioeconómicos; estudar a dinâmica de doenças aquáticas e as suas consequências para a biodiversidade; e desenvolver ferramentas aplicadas à gestão e à tomada de decisões. As suas linhas atuais incluem estratégias de prioridade na gestão de espécies invasoras e o estudo daquelas com valor comercial, dada a sua estreita interligação ecológica, económica e social.

[EN] Dr. Francisco J. Oficialdegui holds a PhD in Biology from the University of Seville and completed his doctoral thesis at the Doñana Biological Station (EBD-CSIC). During his postdoctoral stage, he worked at several Spanish institutions and at universities in the Netherlands and the Czech Republic, and has also carried out consultancy work for companies and international organizations such as the European Commission and the IUCN. He is currently a postdoctoral researcher at EBD-CSIC under a competitive contract funded by the Government of Andalusia. His research focuses on freshwater biological invasions, integrating ecological, molecular and socio-economic approaches. Using freshwater crayfish as a main study model, he analyzes introduction pathways and routes from historical, social and molecular perspectives; assesses ecological and socio-economic impacts; investigates disease dynamics in aquatic ecosystems and their consequences for biodiversity; and develops tools to support management and decision-making. His current research lines include prioritization strategies in invasive species management and the study of invasive species with commercial value, given their close ecological, economic and social interconnections.

Naiara López-Rojo

INRAE – Université Savoie Mont Blanc, CNRS / LECA. France / Francia.

"When flow stops: carbon dynamics and biodiversity patterns in drying river networks"

[ES] Su investigación se centra en analizar cómo los componentes del cambio global afectan al funcionamiento de los ecosistemas fluviales y a las comunidades bióticas. Durante el doctorado estudió los efectos de la pérdida de biodiversidad de la vegetación ribereña sobre el funcionamiento de arroyos de cabecera, especialmente la descomposición de la hojarasca, el ciclo de nutrientes y las comunidades de invertebrados, mediante experimentos en condiciones controladas (microcosmos y mesocosmos). Asimismo, ha participado en proyectos que evalúan los efectos de contaminantes, como fungicidas y microplásticos, sobre el funcionamiento de los ecosistemas y la supervivencia de invertebrados y anfibios. Posteriormente se incorporó a INRAE (Francia), donde investigó los efectos de la intermitencia del flujo y del secado, con especial atención a las emisiones de carbono, el metabolismo fluvial y sus vínculos con la diversidad microbiana. Actualmente forma parte del Core Team de un proyecto global que analiza cómo la variabilidad hidrológica influye en la dinámica funcional y biótica de los ecosistemas fluviales.

[PT] A sua investigação centra-se em como os componentes da mudança global afetam o funcionamento dos ecossistemas fluviais e das comunidades bióticas. Durante o doutoramento, estudou os efeitos da perda de biodiversidade da vegetação ribeirinha no funcionamento de ribeiros de cabeceira, com destaque para a decomposição da folhada, o ciclo de nutrientes e as comunidades de invertebrados, através de experiências em condições controladas (microcosmos e mesocosmos). Participou também em projetos que avaliam os efeitos de poluentes, como fungicidas e microplásticos, no funcionamento dos ecossistemas e na sobrevivência de invertebrados e anfíbios. Posteriormente, integrou o INRAE (França), onde investigou os efeitos da intermitência do caudal e da seca, com particular atenção às emissões de carbono, ao metabolismo fluvial e às suas relações com a diversidade microbiana. Atualmente integra a Core Team de um projeto global que analisa como a variabilidade hidrológica influencia a dinâmica funcional e biótica dos ecossistemas fluviais.

[EN] Her research focuses on how different components of global change alter the functioning of fluvial ecosystems and biotic communities. During her PhD, she analyzed the effects of riparian vegetation biodiversity loss on the functioning of headwater streams — particularly leaf litter decomposition, nutrient cycling and associated invertebrate communities — through laboratory experiments under controlled conditions (microcosms and mesocosms). She has also participated in projects assessing the effects of pollutants such as fungicides and microplastics on ecosystem functioning and the survival of invertebrates and amphibians. She later joined INRAE (France), where she investigated the effects of flow intermittency and drying on fluvial ecosystem functioning, with a particular focus on carbon emissions, stream metabolism and their links with microbial diversity. She is currently part of the Core Team of a global project examining how hydrological variability shapes the functional and biotic dynamics of fluvial ecosystems.

Patricia M.ª Rodríguez-González

Universidade de Lisboa. Portugal.

"Bringing riparian vegetation from background to foreground"

[ES] Patricia M.ª Rodríguez González es profesora en el Instituto Superior de Agronomía de la Universidad de Lisboa y desarrolla su actividad investigadora en el Centro de Estudios Forestales y el Laboratorio Asociado TERRA. Su investigación se centra en la ecología de ecosistemas ribereños y humedales, con especial atención a la caracterización, modelización, evaluación y seguimiento de la vegetación ribereña. Sus líneas actuales abordan: i) el estudio de las respuestas de la vegetación ribereña a factores abióticos (hidroclimáticos) y bióticos (invasiones biológicas, enfermedades emergentes) a distintas escalas espaciales, mediante enfoques funcionales como la ecología funcional, la dendroecología y la ecohidrología; y ii) la aplicación de este conocimiento a la restauración ecológica de ecosistemas fluviales. También trabaja en nuevos enfoques de educación y transferencia del conocimiento. Ha colaborado con la administración pública en la implementación en Portugal de la Directiva Marco del Agua, la Directiva de Hábitats, el Convenio de Ramsar y el Plano Nacional de Restauro. Es co-coordinadora de la Rede Portuguesa de Restauro Ecológico y lidera el Working Group on Education and Training de la Society for Ecological Restoration Europe.

[PT] Patricia M.ª Rodríguez-González é professora no Instituto Superior de Agronomia da Universidade de Lisboa e desenvolve a sua atividade de investigação no Centro de Estudos Florestais e no Laboratório Associado TERRA. A sua investigação centra-se na ecologia dos ecossistemas ribeirinhos e húmidos, com especial atenção à caracterização, modelação, avaliação e monitorização da vegetação ribeirinha. As suas linhas atuais abordam: i) o estudo das respostas da vegetação ribeirinha a fatores abióticos (hidroclimáticos) e bióticos (invasões biológicas, doenças emergentes) em diferentes escalas espaciais, recorrendo a abordagens funcionais como a ecologia funcional, a dendroecologia e a ecohidrologia; e ii) a aplicação deste conhecimento à restauração ecológica de ecossistemas fluviais. Trabalha igualmente em novas abordagens de educação e transferência de conhecimento. Colaborou com a administração pública na implementação em Portugal da Diretiva-Quadro da Água, da Diretiva Habitats, da Convenção de Ramsar e do Plano Nacional de Restauro. É co-coordenadora da Rede Portuguesa de Restauro Ecológico e lidera o Working Group on Education and Training da Society for Ecological Restoration Europe.

[EN] Patricia M.ª Rodríguez-González is a professor at the Instituto Superior de Agronomia of the University of Lisbon. She conducts her research at the Center for Forest Studies and the Associated Laboratory TERRA, focusing on the ecology of riparian and wetland ecosystems, particularly the characterization, modeling, assessment and monitoring of riparian vegetation. Her current research lines include: i) studying riparian vegetation responses to abiotic (e.g. hydroclimatic) and biotic factors (biological invasions, emerging diseases) across different spatial scales, using functional approaches such as functional ecology, dendroecology and ecohydrology; and ii) applying this knowledge to the ecological restoration of river ecosystems. She is also interested in education and scientific knowledge transfer. Beyond academia, she has collaborated with public administrations on the implementation in Portugal of the Water Framework Directive, the Habitats Directive, the Ramsar Convention and the National Restoration Plan. She is co-coordinator of the Portuguese Ecological Restoration Network and leads the Working Group on Education and Training of the Society for Ecological Restoration Europe.

Victor Saito

Universidade Federal de São Carlos. Brasil / Brazil.

"How body size shapes freshwater ecosystems"

[ES] Victor Saito es un ecólogo cuya investigación integra la ecología de comunidades, el funcionamiento de los ecosistemas y la teoría de redes para comprender cómo los sistemas de agua dulce responden al cambio ambiental a lo largo de amplios gradientes latitudinales. Su trabajo se centra en redes tróficas de ecosistemas fluviales, combinando mediciones de campo con enfoques analíticos avanzados para cuantificar el flujo de energía a través de las cadenas tróficas acuáticas en contextos ambientales contrastantes. Al vincular rasgos de los organismos, distribuciones del tamaño corporal y la estructura de las redes tróficas, investiga los mecanismos que organizan la biodiversidad desde regiones tropicales hasta templadas y cómo estos cambian con la temperatura, el uso del suelo, la urbanización y la propagación de especies no nativas. Sus estudios muestran cómo las alteraciones ambientales afectan procesos clave como los flujos de energía, la producción secundaria y la estabilidad de las interacciones tróficas. Mediante proyectos que integran experimentos, datos de campo y modelos matemáticos, su trabajo aporta nuevas perspectivas sobre la resiliencia y el funcionamiento de los ecosistemas fluviales en un mundo en rápido cambio.

[PT] Victor Saito é um ecólogo cuja investigação integra a ecologia de comunidades, o funcionamento dos ecossistemas e a teoria de redes para compreender como os sistemas de água doce respondem às alterações ambientais ao longo de amplos gradientes latitudinais. O seu trabalho centra-se nas redes tróficas de ecossistemas fluviais, combinando medições de campo com abordagens analíticas avançadas para quantificar o fluxo de energia através das cadeias tróficas aquáticas em contextos ambientais contrastantes. Ao relacionar traços dos organismos, distribuições de tamanho corporal e a estrutura das redes tróficas, investiga os mecanismos que organizam a biodiversidade desde regiões tropicais até temperadas e como estes se alteram com a temperatura, o uso do solo, a urbanização e a propagação de espécies não nativas. Os seus estudos mostram como as alterações ambientais afetam processos chave, como os fluxos de energia, a produção secundária e a estabilidade das interações tróficas. Através de projetos que integram experiências, dados de campo e modelos matemáticos, o seu trabalho traz novas perspetivas sobre a resiliência e o funcionamento dos ecossistemas fluviais num mundo em rápida mudança.

[EN] Victor Saito is an ecologist whose research integrates community ecology, ecosystem functioning and network theory to understand how freshwater systems respond to environmental change across broad latitudinal gradients. His work focuses on trophic networks in fluvial ecosystems, combining field measurements with advanced analytical approaches to quantify energy flow through aquatic food webs under contrasting environmental conditions. By linking organism traits, body-size distributions and food web structure, he investigates the mechanisms that organise biodiversity from tropical to temperate regions and how these mechanisms change with temperature, land-use change, urbanisation and the spread of non-native species. His studies show how environmental alterations affect key ecosystem processes such as energy flows, secondary production and the stability of trophic interactions. Through projects integrating experiments, field data and mathematical models, his work provides new insights into the resilience and functioning of fluvial ecosystems in a rapidly changing world.

Manuel A. S. Graça

Universidade de Coimbra & MARE. Portugal.

Conferencia Ramón Margalef: Premio a la trayectoria en limnología · Conferência Ramón Margalef: Prémio de carreira em limnologia · Ramón Margalef conference: Lifetime achievement award in limnology

"Hojarasca, hongos y macroinvertebrados: riachuelos en acción"

[ES] Manuel Graça es doctor en Biología por la Universidad de Sheffield, Reino Unido. Actualmente jubilado, fue profesor catedrático de Ecología en la Universidad de Coímbra, Portugal. Su investigación se ha centrado en la ecología de pequeños ríos, en particular con el objetivo de comprender los procesos que regulan la descomposición de la hojarasca que entra en ellos y su papel como fuente de energía y nutrientes para las comunidades acuáticas. En este sentido, ha trabajado con hongos e invertebrados acuáticos, tanto en el laboratorio como en trabajos de manipulación en ríos. Su trabajo de campo se ha realizado en diversos entornos ribereños de Portugal, Venezuela, Ecuador, Argentina y Brasil. Paralelamente, Manuel Graça se interesa por comprender cómo los factores de estrés ambiental afectan la ecología y los parámetros funcionales de los descomponedores. Finalmente, ha colaborado con las autoridades ambientales y la industria en evaluaciones de la calidad ambiental para medir la eficacia de las medidas de mitigación de la contaminación. Es editor de un libro sobre métodos para el estudio de la descomposición en aguas continentales y otro sobre los ríos de Sudamérica.

[PT] Manuel Graça é doutorado em Biologia pela Universidade de Sheffield, Reino Unido. Atualmente aposentado, foi professor catedrático de Ecologia na Universidade de Coimbra, Portugal. A sua investigação tem-se centrado na ecologia de pequenos rios, particularmente com o objetivo de compreender os processos que regulam a decomposição da folhada que entra nos rios e o seu papel como fonte de energia e nutrientes para as comunidades aquáticas. Neste sentido, tem trabalhado com fungos e invertebrados aquáticos, tanto em laboratório como em experiências de manipulação em rios. O seu trabalho de campo tem sido desenvolvido em diversos ambientes ribeirinhos de Portugal, Venezuela, Equador, Argentina e Brasil. Paralelamente, Manuel Graça interessa-se por compreender como os fatores de stresse ambiental afetam a ecologia e os parâmetros funcionais dos decompositores. Por fim, tem colaborado com as autoridades ambientais e a indústria em avaliações da qualidade ambiental para medir a eficácia das medidas de mitigação da poluição. É editor de um livro sobre métodos para o estudo da decomposição em águas continentais e de outro sobre os rios da América do Sul.

[EN] Manuel Graça holds a PhD in Biology from the University of Sheffield, United Kingdom. Currently retired, he was a full professor of Ecology at the University of Coimbra, Portugal. His research has focused on the ecology of small rivers, particularly to understand the processes that regulate the decomposition of leaf litter entering rivers and its role as a source of energy and nutrients for aquatic communities. In this sense, he has worked with aquatic fungi and invertebrates, both in the laboratory and in manipulative experiments in rivers. His fieldwork has been conducted in various riverine environments across Portugal, Venezuela, Ecuador, Argentina and Brazil. In parallel, Manuel Graça is interested in understanding how environmental stressors affect the ecology and functional parameters of decomposers. Finally, he has collaborated with environmental authorities and industry on environmental quality assessments to measure the effectiveness of pollution mitigation measures. He is the editor of a book on methods for studying decomposition in inland waters and another on the rivers of South America.

Alberto Alonso Blanco

Universidad del País Vasco / Euskal Herriko Unibertsitatea (EHU). España / Spain.

Premio a la mejor tesis en limnología · Prémio de melhor tese em limnologia · Award for the best thesis in limnology — 2024

"Functional consequences of biodiversity loss caused by emergent diseases in freshwater ecosystems"

[ES] Alberto Alonso es investigador en la Universidad del País Vasco / Euskal Herriko Unibertsitatea (EHU) y su investigación se centra en analizar los efectos de la pérdida de biodiversidad y el cambio de especies en la estructura y funcionamiento de los ecosistemas de agua dulce. Durante el doctorado estudió los efectos de la pérdida de diversidad por patógenos fúngicos emergentes en ecosistemas fluviales, concretamente los producidos por la pérdida y sustitución de especies de árboles y anfibios en la descomposición de hojarasca, crecimiento de perifiton y comunidades de macroinvertebrados, hifomicetos acuáticos y algas, mediante experimentos en campo y en condiciones controladas en laboratorio (microcosmos y mesocosmos). Además de otros estudios sobre pérdida de diversidad y especies invasoras con diferentes taxones, también ha participado en proyectos con otros impactos como cambios en el uso del suelo, pesticidas, nutrientes o aumento de temperatura.

[PT] Alberto Alonso é investigador na Universidade do País Basco / Euskal Herriko Unibertsitatea (EHU), e a sua investigação centra-se em analisar os efeitos da perda de biodiversidade e da mudança de espécies na estrutura e no funcionamento dos ecossistemas de água doce. Durante o doutoramento estudou os efeitos da perda de diversidade por patógenos fúngicos emergentes em ecossistemas fluviais, concretamente os produzidos pela perda e substituição de espécies de árvores e anfíbios na decomposição da folhada, no crescimento de perifíton e nas comunidades de macroinvertebrados, hifomicetes aquáticos e algas, através de experiências em campo e em condições controladas em laboratório (microcosmos e mesocosmos). Para além de outros estudos sobre perda de diversidade e espécies invasoras com diferentes taxa, também participou em projetos com outros impactos, como alterações no uso do solo, pesticidas, nutrientes ou aumento da temperatura.

[EN] Alberto Alonso is a researcher at the University of the Basque Country / Euskal Herriko Unibertsitatea (EHU), and his research focuses on analyzing the effects of biodiversity loss and species change on the structure and functioning of freshwater ecosystems. During his PhD, he studied the effects of diversity loss caused by emerging fungal pathogens in river ecosystems — specifically those produced by the loss and replacement of tree and amphibian species — on leaf litter decomposition, periphyton growth, and the communities of macroinvertebrates, aquatic hyphomycetes and algae, through field experiments and controlled laboratory conditions (microcosms and mesocosms). In addition to other studies on diversity loss and invasive species involving different taxa, he has also participated in projects examining other impacts such as land-use changes, pesticides, nutrients, or temperature increase.

Ismael Soto

Estación Biológica de Doñana (EBD–CSIC). España / Spain.

Premio a la mejor tesis en limnología · Prémio de melhor tese em limnologia · Award for the best thesis in limnology — 2025

"Long-term trends and impacts of biological invasions"

[ES] Ismael Soto es investigador postdoctoral en la Estación Biológica de Doñana, especializado en biología de invasiones, centrándose en los patrones espacio-temporales de expansión de especies no nativas a escala global y regional. Además, una línea central de su investigación aborda los impactos económicos de dichas especies, evaluando la magnitud, la distribución y la evolución temporal de los costes asociados a los daños ambientales, las pérdidas productivas y los gastos de gestión.

[PT] Ismael Soto é investigador de pós-doutoramento na Estação Biológica de Doñana, especializado em biologia de invasões, focando-se nos padrões espácio-temporais de expansão de espécies não nativas à escala global e regional. Além disso, uma linha central da sua investigação aborda os impactos económicos dessas espécies, avaliando a magnitude, a distribuição e a evolução temporal dos custos associados aos danos ambientais, às perdas produtivas e às despesas de gestão.

[EN] Ismael Soto is a postdoctoral researcher at the Doñana Biological Station, specializing in invasion biology and focusing on the spatio-temporal patterns of non-native species expansion at global and regional scales. A central line of his research also addresses the economic impacts of these species, assessing the magnitude, distribution and temporal evolution of the costs associated with environmental damage, productive losses and management expenditures.

SESIONES GENERALES · SESSÕES GERAIS · GENERAL SESSIONS

[ES] SG01. Biología de la conservación de los organismos acuáticos
[PT] SG01. Biologia da conservação dos organismos aquáticos
[EN] SG01. Biology and conservation of freshwater organisms

[ES] SG02. Ecología de ríos, estuarios, lagos, embalses y humedales
[PT] SG02. Ecologia de rios, estuários, lagos, albufeiras e zonas húmidas
[EN] SG02. Ecology of rivers, estuaries, lakes, reservoirs and wetlands

[ES] SG03. Procesos y funcionamiento de los sistemas acuáticos
[PT] SG03. Processos e funcionamento dos sistemas aquáticos
[EN] SG03. Processes and functioning of freshwater ecosystems

[ES] SG04. Ecohidrología y aguas subterráneas
[PT] SG04. Ecohidrologia e águas subterrâneas
[EN] SG04. Ecohydrology and underground water

[ES] SG05. Ecotoxicología acuática y evaluación del riesgo ambiental
[PT] SG05. Ecotoxicologia aquática e avaliação do risco ambiental
[EN] SG05. Aquatic ecotoxicology and environmental risk assessment

[ES] SG06. Ecología microbiana
[PT] SG06. Ecologia microbiana
[EN] SG06. Microbial ecology

[ES] SG07. Cambios globales: cambios climáticos y antrópicos, pretéritos y actuales
[PT] SG07. Alterações globais: alterações climáticas e antrópicas, passadas e atuais
[EN] SG07. Global change: climate change, human impacts, past and current

[ES] SG08. Especies invasoras y funcionamiento de ecosistemas
[PT] SG08. Espécies invasoras e funcionamento de ecossistemas
[EN] SG08. Invasive species and ecosystem functioning

[ES] SG09. Restauración de ecosistemas
[PT] SG09. Restauração de ecossistemas
[EN] SG09. Ecosystem restoration

[ES] SG10. Nuevas metodologías y técnicas en limnología
[PT] SG10. Novas metodologias e técnicas em limnologia
[EN] SG10. New methodologies and techniques in limnology

[ES] SG11. Servicios de los ecosistemas y metodologías de evaluación
[PT] SG11. Serviços dos ecossistemas e metodologias de avaliação
[EN] SG11. Ecosystem services and assessment methods

SESIONES ESPECIALES · SESSÕES ESPECIAIS · SPECIAL SESSIONS

[ES] SE01. Funcionamiento de los ecosistemas de agua dulce en un mundo en rápido cambio

[PT] SE01. Funcionamento dos ecossistemas de água doce num mundo em rápida mudança

[EN] SE01. Freshwater ecosystem functioning in a rapidly changing world

Ariadna García-Astillero, Guillermo García-Gómez, Ignasi Arranz Urgell, Javier Sánchez-Hernández

[ES] SE02. El lado oscuro de la ecología fluvial: comprensión del papel de la zona hiporreica en la biogeoquímica de los ríos

[PT] SE02. O lado obscuro da ecologia fluvial: compreender o papel da zona hiporreica na biogeoquímica dos rios

[EN] SE02. The dark side of stream ecology: advancing our understanding of the hyporheic zone role for stream biogeochemistry

Clara Mendoza-Lera, Marina Victoria Ríos, Julia Pasqualini

[ES] SE03. Miguel Alonso, el naturalista y sus lagunas

[PT] SE03. Miguel Alonso, o naturalista e as suas lagoas

[EN] SE03. Miguel Alonso, the naturalist and his lagoons

Antonio Camacho, Concha Duran, Manuel Toro, Francesc Mesquita

[ES] SE04. Redes colaborativas en limnología

[PT] SE04. Redes colaborativas em limnologia

[EN] SE04. Collaborative networks in limnology

Javier Pérez, Cayetano Gutiérrez-Cánovas, Juan Rubio-Ríos

[ES] SE05. Retos de investigación y gestión en ríos no permanentes

[PT] SE05. Desafios de investigação e gestão em rios não perenes

[EN] SE05. Research and management challenges in non-perennial rivers

María Mar Sánchez-Montoya, Núria Bonada, Núria Cid, Pablo Rodríguez-Lozano, Daniel von Schiller

[ES] SE06. Conectando ciencia y sociedad en limnología: ciencia ciudadana, educación y participación

[PT] SE06. Ligando ciência e sociedade na limnologia: ciência cidadã, educação e participação

[EN] SE06. Bridging science and society in limnology: citizen science, education and stakeholder participation

Maria Soria, Meritxell Abril, Pau Fortuño

[ES] SE07. Ecología molecular y biodiversidad: nuevas perspectivas en ecosistemas acuáticos

[PT] SE07. Ecologia molecular e biodiversidade: novas perspetivas em ecossistemas aquáticos

[EN] SE07. Molecular ecology and biodiversity: new perspectives in aquatic ecosystems

Jon Garrastatxu, Álvaro Fueyo, Alba M. Losa, Nieves López-Rodríguez

[ES] SE08. Las aguas continentales de la Macaronesia: recursos hídricos, biodiversidad y gestión

[PT] SE08. As águas continentais da Macaronésia: recursos hídricos, biodiversidade e gestão

[EN] SE08. Freshwaters from the Macaronesia: water resources, biodiversity and conservation management

Núria Cid, Raúl Acosta, Margarita Florencio, Pedro Raposeiro

[ES] SE09. De la limnología a la innovación tecnológica: Soluciones Basadas en la Naturaleza y la Estrategia Europea de Resiliencia del Agua

[PT] SE09. Da limnologia à inovação tecnológica: Soluções Baseadas na Natureza e a Estratégia Europeia de Resiliência da Água

[EN] SE09. From limnology to technological innovation: Nature-Based Solutions as contributors to the European Water Resilience Strategy

Ainhoa Gaudes, Julio C. López Doval, Lluís Bertrans Tubau

[ES] SE10. Interacciones biogeoquímicas y microbianas a gran escala en el funcionamiento de los ecosistemas de agua dulce

LIBRO DE RESÚMENES

LIVRO DE RESUMOS

ABSTRACT BOOK

Why ponds concentrate nutrients: the roles of internal features, land use, and climate

Mireia Bartrons[1]*, Jing Yang[1], Maria Cuenca-Cambronero[1], Pieter Lemmens[2,3,4], Maria Anton- Pardo[5,6], Meryem Beklioğlu[7], Jeremy Biggs[8], Aurélie Boissezon[9], Dani Boix[5], Clementina Calvo[10], Maite Colina[10,11], Thomas A. Davidson[12], Luc De Meester[2,3], Julie C. Fahy[9], Helen M. Greaves[13], Hilal Kiran[7], Eti E. Levi[11], Mariana Meerhoff[10,12], Thomas Mehner[2], Emine B. Mülayim[7], Beat Oertli[9], Ian R. Patmore[13], Carl D. Sayer[13], Jordi Villà-Freixa[1,14], Sandra Brucet[1,15,16]

[1]Biosciences Department, University of Vic - Central University of Catalonia, 08500 Vic, Catalonia, Spain. [2]Leibniz Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany (IGB). [3]Laboratory of Aquatic Ecology, Evolution and Conservation, KU Leuven, Leuven, Belgium [4]Research Institute for Nature and Forest (INBO), Brussels, Belgium [5]GRECO, Institute of Aquatic Ecology, University of Girona, Girona, Spain. [6]Cavanilles Institute of Biodiversity and Evolutionary Biology, Universitat de València, Spain [7]Middle East Technical University, Department of Biological Sciences, Limnology Laboratory and Centre for Ecosystem Research (EKOSAM), Ankara, Türkiye. [8]Freshwater Habitats Trust, UK [9]HEPIA, HES-SO, University of Applied Sciences and Arts Western Switzerland, 150 Route de Presinge, 1254 Jussy-Geneva, Switzerland [10]Departament of Ecology and Environmental Management, Centro Universitario Regional del Este, Universidad de la República, Maldonado, Uruguay [11]Department of Ecology, Faculty of Science, Radboud University, Nijmegen, Netherlands [12]Department of Ecoscience, Aarhus University, Aarhus, Denmark [13]Pond Restoration Research Group, Department of Geography, University College London, London, UK [14]Institute for Research and Innovation in Life and Health Sciences in Central Catalonia (IrisCC), Vic, Spain. [15]ICREA, Catalan Institution for Research and Advanced Studies, Barcelona, Spain [16]Fundació Privada Bionexus, 17003, Girona, Spain

mireia.bartrons@uvic.cat

Ponds are key freshwater habitats supporting biodiversity and ecosystem services, yet they remain understudied in the context of land-use and climate change. We examined 240 ponds across eight countries (seven in Europe and Uruguay) to assess how internal pond characteristics, surrounding land cover and livestock intensity, seasonal climatic variation and climate influence nutrient concentrations across spatial and temporal scales. Nutrient concentrations were strongly associated with internal features: shallow ponds and short hydroperiods had higher total nitrogen (TN) and total phosphorus (TP) concentrations, while thermal stratification, typically found in deeper ponds, was associated with higher TN, indicating enhanced internal nutrient recycling. Land use also played a significant role with agricultural intensity increasing nutrient concentration (both TN and TP), whereas forest cover reduced TP. Seasonal variation modulated these patterns, with higher TP concentrations observed in summer, and with dilution effects during wetter and cooler periods, particularly for TN in semi-permanent ponds. These findings underscore the combined influence of physical characteristics, landscape context, and climate variability on nutrient concentrations in ponds, and highlight the need for integrated, multi-scale approaches to anticipate the impacts of global climate change effects on these ecologically valuable ecosystems.

Salty from the top: tracing salinity changes in the Gambia river using satellite imagery

Núria Catalán[1]*, Alexander Ameroth[1], Momodou Jasseh Faal[2], Amuzo Nkamnebe[2], Nieves López-Rodríguez[3], Elsa Bisbal[1], Pablo Rodríguez-Lozano[4], Momodou Bah[5], Miguel Cañedo-Argüelles[3], Camille Minaudo[6]

[1]Centre d'Estudis Avançats de Blanes (CEAB-CSIC) Blanes, Girona, Spain. [2]GREAT Institute, Brusubi Phase II, The Gambia, West Africa. [3]Institut de Diagnòstic Ambiental i Estudis de l'Aigua (IDAEA-CSIC), 08034 Barcelona, Spain. [4]Inland-Water Ecosystems Team (I-WET), Departamento de Ecología, Universidad Autónoma de Madrid, Madrid 28049, Spain. [5]Department of Biology, Sciences and Art Unit, University of The Gambia, Serrekunda, The Gambia. [6]Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Spain.

nuria.catalan@ceab.csic.es

Seawater intrusion driven by climate change is intensifying salinization in low-lying river systems worldwide, threatening ecosystems and human livelihoods. In The Gambia, saline water has advanced up to 250 km upstream along the river, jeopardizing freshwater supplies for rice cultivation, fisheries, and mangrove ecosystems. This socio-ecological system is further stressed by reduced freshwater inflow due to climate variability, water abstraction, and the construction of the Sambangalou Dam, expected to alter the natural hydrological regime. Within the SALBIA project, we combine remote sensing and in-situ monitoring to trace longitudinal salinity dynamics and associated changes in water optical properties. We processed atmospherically corrected Sentinel-2 MSI, Landsat-5 TM, Landsat-7 ETM+, Landsat-8 OLI and Landsat-9 OLI-2 to analyse water-leaving reflectance over the period 1984-2026 over a 500 km river stretch (Basse to Banjul). We computed a series of water optical metrics serving as proxies for salinity, chromophoric dissolved organic matter (CDOM), total suspended solids (TSS), and chlorophyll-a concentrations. River-specific empirical relationships were calibrated using satellite matchups with in-situ measurements of the previous variables obtained during field campaigns. Water optical properties reveal a clear longitudinal pattern and align with in-situ measurements across the freshwater-to-saline transition zone. We observed a bell-shape longitudinal trend in CDOM and TSS with its maxima in the intermediate section of the salinity transition zone and moving upstream or downstream according to the season. The pattern downstream is consistent with reduced terrestrial inputs and enhanced marine influence. The position of the saline front oscillates over a river-distance of about 75 km, and preliminary results reveal its marked upstream shift during recent dry seasons. These optical indicators closely track modeled salinity gradients, demonstrating that satellite-derived products can serve as effective proxies for salinity intrusion in data-scarce tropical estuaries. Our integrative approach provides the first coupled optical–hydrological assessments of salinization in the Gambia River and delivers actionable information to support adaptive water management strategies in highly vulnerable coastal river systems.

Wastewater effluent and climate change effects on stream hydrology and water quality using SWAT+

Gabriela Córdoba-Ariza[1]* , Laurie Boithias[2] , Oriana Llanos-Paez[3] , Sergi Sabater[1,4], Josep Mas- Pla[1,4], Ramon J. Batalla[5,1]

[1]Institut Català de Recerca de l'Aigua, Emili Grahit 101 17001, E-mail: Girona, Spain. [2]Géosciences Environnement Toulouse, 14 av. Edouard Belin, 31400 Toulouse, France. [3]Alpine and Polar Environmental Research Center (ALPOLE), Ecole Polytechnique Fédéralede Lausanne (EPFL), Route des Ronquos 86 1951, Sion, Switzerland. [4]Universitat de Girona, IEA and Geocamb, Girona, Spain. [5]University of Lleida, Fluvial Dynamics Research Group (RIUS), Lleida, Spain

gcordoba@icra.cat

Non-perennial rivers in Mediterranean basins exhibit highly variable hydrological regimes, where water scarcity is often exacerbated by intense human activity. Under these conditions, wastewater treatment plant (WWTP) effluents can play a key role in sustaining low flows. Therefore, understanding their contribution to river hydrology and water quality is essential for effective environmental management, particularly regarding issues such as emerging contaminants. This study employs the Soil and Water Assessment Tool (SWAT+) to simulate current and future hydrological dynamics in the Onyar River basin (NE Spain), where declining streamflow coincides with climate change and rising water demand. A spatially semi- distributed SWAT+ model was calibrated and validated using discharge observations and incorporates key anthropogenic drivers, including irrigation withdrawals, WWTP effluents, and land-use changes, together with climatic projections derived from regional climate scenarios. Model results highlight the importance of WWTP effluents in sustaining streamflow during low-flow periods and quantify their influence on hydrological dynamics across spatial scales within the basin. While headwater reaches tend to remain intermittent, WWTP discharges in downstream reaches represent a substantial percentage of baseflow during dry periods, increasing the temporal persistence of flow in otherwise intermittent sections. Projected climatic shifts, characterized by reduced precipitation and higher temperatures, are expected to exert strong pressure on the hydrological regime and further enhance flow intermittency. As natural water availability declines, WWTP inputs become a critical component of river flow, partially counterbalancing projected reductions in streamflow while increasing the risk of water quality deterioration. These findings underscore the need for integrated water resource management strategies explicitly considering wastewater reuse as a potential measure to mitigate the ecological and water availability impacts of climate change in non-perennial Mediterranean rivers. Our model also provides a basis for future work investigating how wastewater inputs influence nutrient and emerging pollutant dynamics within the basin. Funding: Project EC-FATE,AEI- PID2022-139911OB-C42.

Does microbial biodiversity mediate resource constraints on ecosystem functioning across freshwater ecosystems?

Guillermo García-Gómez[1,2]*, Javier Sánchez-Hernández[1,2], José Antonio Más Gutiérrez[3], Juan Rubio Ríos[1,2], Pilar Hurtado Aragüés[1], Alejandro Martínez[4] , Ignasi Arranz[1,2]

[1]Instituto de Investigación en Cambio Global (IICG-URJC), Universidad Rey Juan Carlos, Tulipán s/n, 28933. Móstoles, Spain. [2]Departamento de Biología y Geología, Física y Química Inorgánica, Universidad Rey Juan Carlos (URJC), Tulipán s/n, 28933. Móstoles, Spain. [3] Centro de Apoyo Tecnológico, Universidad Rey Juan Carlos (CAT-URJC), Avda Atenas s/n. Departamental I, Laboratorio 015, 28922. Alcorcón, Spain. [4] Molecular Ecology Group (MEG), Water Research Institute (IRSA), National Research Council of Italy (CNR). Largo Tonolli, 50. 28922. Verbania, Italy

guillegar.gz@gmail.com

Microbial communities comprise an enormous functional and taxonomic diversity that play a key role in biogeochemical cycles on Earth. Yet, the mechanisms by which size-related energetic constraints shape microbial size structure across spatial gradients remain unclear, thus limiting our understanding on the role of microbes on energy fluxes. The relationship between size (M) and abundance (N) provides a mechanistic link between resource availability and energy transfer within food webs. Theoretical predictions suggest that, under low resource conditions, communities tend to be more dominated by small-celled organisms than large organisms due to their lower absolute energy demands and relatively higher uptake capacity. However, community composition may modify this expectation, as greater functional and taxonomic diversity can promote resource partitioning and enhance total resource use. Here, we assess whether resource- driven variation in N–M relationships is mediated by functional or taxonomic diversity. Specifically, we hypothesise that (i) low-diversity communities will be dominated by small-sized taxa and thus exhibit steeper N–M slopes (i.e., lower proportion of large organisms) and reduced total biovolume, whereas (ii) high-diversity communities will exhibit shallower N–M slopes and increased biovolume due to greater complementarity in resource use. We test these predictions across 30 discrete freshwater ecosystems (mountain lakes, ponds and small reservoirs) from three massifs in the Iberian Peninsula spanning broad resource gradients driven by natural and anthropogenic inputs. Using flow cytometry, we quantified cell volume and abundance to estimate size structure and biovolume of microbial communities (0.2-20 µm). Functional and taxonomic diversity were respectively assessed by fluorescence differences among organisms and metabarcoding. This study aims at testing whether microbial diversity can mitigate resource constraints on community size structure and biomass, with implications for ecosystem functions such as carbon fixation, primary production and energy fluxes.

Habitat, topography and land use shape microbial eukaryotic interaction networks across river systems

Alejandra Goldenberg-Vilar*, María Morán-Luis, Alba M. Losa, José Barquín

IHCantabria – Instituto de Hidráulica Ambiental de la Universidad de Cantabria, Santander, Spain

alejandra.goldenberg@unican.es

River ecosystems show longitudinal gradients in physicochemical and biological conditions from headwaters to estuaries. Along this river continuum, microbial communities play a central role in biogeochemical cycling and organic matter processing. Although the environmental drivers shaping community composition in rivers have been widely investigated, the drivers of microbial interaction networks remain largely unexplored, particularly for eukaryotes, which have received far less attention than prokaryotes. Co-occurrence network analysis provides a powerful framework to infer potential ecological interactions and to assess patterns of community complexity, organization, and resilience to environmental change. Here, we investigated co-occurrence networks of microbial eukaryotes across six European river basins located in Spain, Portugal, France, and Ireland–UK. We analyzed fungal, algal, and heterotrophic protistan communities from both water and biofilm habitats and assessed how habitat compartment, organismal group, catchment topography, and land use shape network structure by applying linear mixed models and variation partitioning. Water communities exhibited higher richness, connectivity and number of interactions than biofilm communities, indicating more complex and highly interconnected networks. In contrast, biofilm communities showed more specialized assemblages structured into distinct modules. Network position was associated with progressively higher abundance (higher number of reads) within the network, higher richness, and the emergence of highly connected taxa (hubs) for both water and biofilm networks, revealing shifts in network organization along the river continuum. Anthropogenic pressures, such as urban and agricultural land cover, significantly influenced network diversity and interaction patterns, although the effects depend on the matrix (biofilm or water networks), organisms and basin. Among the groups analyzed, networks of fungal communities were the most responsive to land use, highlighting their strong potential as bioindicators of anthropic activities in the catchment. Overall, our results demonstrate that water or biofilm compartment is a major determinant of microbial eukaryotic network structure, while topography and land use further modulate these interaction patterns.

Modeling seawater intrusion in The Gambia River

Daniela Henry-Pinilla[1], Rafael Marcé[2], Momodou Jasseh Faal[3], Camille Minaudo[4], Amuzo Nkamnebe[3], Pablo Rodríguez-Lozano[5], Miguel Cañedo-Argüelles[1], Elsa Bisbal[2,4], Momodou Bah[6], Luc Descroix[7], Bor van der Scheer[8], Mai-Britt Berghöfer[9], Núria Catalán[2]*

[1]Institute of environmental assessment and water research (IDAEA-CSIC), 08034, Barcelona, Spain. [2]Centre d'estudis avançats de Blanes (CEAB-CSIC), 17300, Blanes, Spain. [3]GREAT Institute, Brusubi Phase II, The Gambia, West Africa. [4]Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Spain. [5]Inland-Water Ecosystems Team (I-WET), Departamento de Ecología, Universidad Autónoma de Madrid, Madrid 28049, Spain. [6]Department of Biology, Sciences and Art Unit, University of The Gambia, Serrekunda, The Gambia. [7]Patrimoines locaux, Environnement et Globalisation (MNHN, IRD, CNRS), Paris, France. [8]Delf University of Technology, Delf, Netherlands. [9]Department of Physics and Astronomy, University of Potsdam, Potsdam, Germany

daniela.henry@ceab.csic.es

The Gambia River sustains hundreds of thousands of people by providing freshwater for rice cultivation and other crops, supporting fisheries, and maintaining mangrove ecosystems that enable oyster harvesting. However, this socio-ecological system is increasingly threatened by seawater intrusion. As one of the world's most vulnerable countries to sea-level rise, The Gambia is already experiencing seawater intrusion, intensified by interacting drivers: shifts in precipitation and temperature patterns, increased water extraction that lowers the freshwater table, and the construction of a dam in Senegal expected to alter the natural hydrological regime. Our objective is to assess how these combined pressures shape both the location and extent of the saline front, as well as its variability over time and across scenarios. Ultimately, we aim to understand the functioning of the Gambia River system to support the development of urgently needed adaptation strategies. To do so, we applied the SALNST model, a 1-D estuarine model that represents the inland migration of the estuary. It simulates how freshwater inputs constrain seawater intrusion, while tides, sea-level rise, and channel shape favour salinity propagation. The model follows the main river axis and accounts for spatial variations in channel width, depth, and geometry, allowing us to explore the effects of climatic, hydrological, and dam management scenarios at a 5-day and 2-km resolution. Model performance was evaluated using high-frequency salinity measurements collected over 2–5 years at three monitoring stations, complemented by daily discharge records spanning 1984–2017. Validation results show that the model reliably reproduces the observed seasonal and interannual salinity patterns. Scenario analyses reveal that seawater intrusion is highly sensitive to changes in freshwater inputs, especially during the dry season. Changes in discharge, intensified irrigation withdrawals, and modified dam operations substantially alter the extent of the saline front. These projections provide crucial insights for biodiversity conservation, agricultural planning, and the resilience of communities whose livelihoods depend on river-based resources.

Carbon metabolism and sediment methane production in Mediterranean shallow lakes and ponds

Daniel Morant*, Carlos Rochera, Antonio Picazo, Javier Miralles-Lorenzo, Antonio Camacho

[1]*Institut Cavanilles de Biodiversitat i Biologia Evolutiva, Universitat de València, C. Catedrático José Beltrán Martínez, nº 2, 46980, Paterna, Spain*

daniel.morant@uv.es

Small ponds and shallow lakes are the most widespread lentic habitats in the Iberian Peninsula, yet their contribution to regional carbon cycling remains poorly quantified. These ecosystems combine high biological productivity with intense benthic–pelagic interactions, which can strongly influence both carbon storage and greenhouse gas (GHG) fluxes. This study quantifies the contributions of the main components of carbon metabolism in representative Mediterranean shallow lakes and ponds of different ecological types by combining seasonal measurements of planktonic and benthic metabolism with ex situ estimates of sediment CH_4 production rates. Metabolic rates varied among ecological types, and trophic status (based on chlorophyll-a) was determinant of differences in ecosystem metabolism. Overall, planktonic and benthic compartments displayed net heterotrophic behaviour, with aerobic respiration exceeding gross primary production. However, the high net production of marginal helophyte vegetation offsets this balance, shifting the whole-system carbon balance toward potential net autotrophy. At the same time, sediments represented an important location for carbon mineralization through methane production. Potential sediment CH_4 production rates differed among lake types and were strongly correlated with sediment organic matter content. Soft-water and fluvial-influenced ponds showed the highest CH_4 fluxes towards the atmosphere, whereas non-saline hardwater systems exhibited much lower values. Although methane production represented a smaller carbon flux compared with primary production and respiration, its high radiative forcing indicates that it may significantly influence the relevance of GHG fluxes of these ecosystems. Our results highlight that the functioning of Iberian ponds and shallow lakes as GHG sinks or sources is strongly controlled by ecological features such as sediment organic matter, macrophyte cover, and trophic conditions, and its alteration. These findings emphasize the importance of small lentic water bodies in regional carbon cycling and the relevance of understanding ecosystem functioning under the ongoing global change.

Freshwater mussel-associated microbiomes contribute to carbon and nitrogen cycling across Iberian rivers

Félix Picazo[1]*, Isabel Reche[1], Joaquim Reis[2], Andrés Tirado[3], Silke Martínez-Moreno[1], Ignacio Peralta-Maraver[1]

[1]Department of Ecology, University of Granada, Faculty of Sciences, Avda. Fuentenueva s/n, 18071, Granada, Spain. [2]Marine and Environmental Sciences Centre (MARE) and Aquatic Research Network (ARNET), University of Lisbon, Faculty of Sciences, Campo Grande, 1749-016, Lisboa. [3]SaBio, Institute of Research in Wildlife and Game Resources IREC-CSIC-UCLM-JCCM, Ronda de Toledo s/n, 13005, Ciudad Real, Spain

fpicazo@ugr.es

Despite considerable research demonstrating the pivotal role of freshwater invertebrates in ecosystem functioning, knowledge of these processes at the holobiont level—the integrated unit of host and associated microbiome—remains scarce. Here, we investigate the role of epi- and endobiotic microbiomes of endangered freshwater mussels in river carbon and nitrogen cycling. We collected shell biofilm and muscle tissue samples from freshwater mussels at 14 localities across five Iberian river basins. and sequenced the V4–V5 region of the bacterial 16S rRNA gene to obtain ASVs and their taxonomic identities. We then inferred the potential metabolic and ecological functions of host-associated microbiomes using the FAPROTAX and PICRUSt2 databases. In addition, we quantified the functional genes pmoA (related to methanotrophy) and nirS and nosZ (associated with denitrification), and conducted an experiment to test whether the shell microbiome reduces dissolved methane and nitrous oxide concentrations in aquaria. Both functional databases revealed a clear metabolic potential for methanotrophy and denitrification in shell biofilm samples. Moreover, functional gene analyses showed higher abundances in shell biofilms than in muscle tissue, with denitrification-related gene abundances similar to those found in the sediments and methanotrophy-related abundances comparable to those observed in the water column. Controlling for host identity, significant differences were detected only for pmoA abundances, which were higher in shell biofilms from the posterior part of the shell (the one not buried in the sediment). Finally, experimental results showed lower dissolved methane and nitrous oxide concentrations in aquaria containing mussels with intact shell biofilms compared with those whose biofilm was removed. Overall, our findings indicate that endangered freshwater mussels act as reservoirs of prokaryotic diversity that perform key ecosystem functions related to carbon and nitrogen cycling.

Response of stream shredders to leaf litter exposed to drying and wastewater: facing food quality loss with behavioral plasticity

Manuel Pinilla-Rosa[1]* , Francesc Oliva[2], Margarita Menéndez[1], Isabel Muñoz[1]

[1]Department of Evolutionary Biology, Ecology and Environmental Sciences, Universitat de Barcelona, Spain.
[2]Department of Genetics, Microbiology and Statistics, Universitat de Barcelona, Spain

manu.pinilla@ub.edu

The impact of multiple anthropogenic stressors in streams can propagate through food chains, producing unpredictable alterations across different trophic levels that are still poorly understood. Due to their high prevalence in streams, we study the effects of induced drying and wastewater treatment plant (WWTP) effluents on leaf litter quality and, consequently, on its consumption by macroinvertebrate shredders. First, we conducted a field experiment placing leaf litter bags in a permanent Mediterranean stream. After microbial colonization, we simulated drying by placing the bags in the streambank, and we finally transferred the bags downstream to the effluent of a WWTP. After addressing the impact of both stressors on leaf litter decomposition and quality, we performed a laboratory experiment with different shredders (caddisflies: *Potamophylax latipennis* and *Sericostoma* sp.; gammarid: *Echinogammarus longisetosus*) measuring their consumption rates, growth rates, and condition. Induced drying decreased both microbial decomposition and leaf litter quality. However, these changes impacted only the consumption rate of the gammarid, since both caddisfly species compensated these changes by selectively feeding on the softer parts of the leaves. The WWTP effluent did not change leaf litter quality, but shredders showed variable responses in their consumption rates, and the caddisflies still exhibited altered feeding behavior and respiration rates, especially when leaves were previously exposed to drying, indicating legacy effects. These results highlight potential impacts of both stressors on stream food chains, due to shedder-specific responses in consumption rates, behavior and condition that could change organic matter processing and, lastly, ecosystem functioning. In addition, we report for the first time a feeding behavior in caddisflies that gives them plasticity to face the presence of low-quality food, potentially enhancing their survival under anthropogenic stressors.

Global change drivers alter biomass and density but not size structure in freshwater experimental food web

Francisco Valente Neto[1]*, Felipe Rezende[1], Daiane Montoia-Comparsi[1], Paula M. Rosa[1], Lucas W. Zorzetti[1], Laura A. Ortega-Corredor[2], Felipe M. Zanon[2], Loiani O. Santana[2], Matheus H. O. Matos[2], Luiz Felipe M. Velho[2], Luzia C. Rodrigues[2], Hugo Sarmento[3], Victor S. Saito[4], Gustavo Q. Romero[1]

[1]Laboratório de Interações Multitróficas e Biodiversidade, Departamento de Biologia Animal, Instituto de Biologia, Universidade Estadual de Campinas (UNICAMP), CP 6109, CEP 13083-970 Campinas, São Paulo, Brazil. [2]Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura (Nupelia), Universidade Estadual de Maringá – UEM, Av. Colombo, 5790, Bloco H-90 - Campus Universitário, Maringá - PR, 87020-900, Brazil. [3]Departamento de Hidrobiologia, Universidade Federal de São Carlos, Rodovia Washington Luiz Km 235, São Carlos, SP, Brazil. [4]Departamento de Ciências Ambientais, Universidade Federal de São Carlos, Rodovia Washington Luiz Km 235, São Carlos, SP, Brazil

fvalenteneto@gmail.com

Global change drivers, such as warming, nutrient enrichment, and leaf litter loss, can disrupt freshwater food webs and biomass distribution, including the relationship between abundance and body mass (i.e., size spectra). Moreover, the combined impact of global change drivers on freshwater communities remains poorly understood, especially in the tropics. We examined responses of community size structure, biomass, and density to warming, nutrient enrichment, and leaf litter loss in a 310 L mesocosm system, assessing from bacteria to macroinvertebrates (i.e., bacteria, picophytoplankton, phytoplankton, zooplankton, and macroinvertebrate communities). Global change drivers did not alter the slope of size spectra, but they did impact biomass and density of particular groups. Biomass of small organisms (bacteria, picophytoplankton) decreased with warming, while biomass of larger organisms (zooplankton and macroinvertebrates) increased when warming was combined with reduced litter inputs. Overall, total density and densities of bacteria, picophytoplankton, and phytoplankton declined with warming, and leaf litter reduction. Our findings suggest that global change drivers mainly affect aquatic communities by changing total biomass and densities rather than reshaping size structure. While global change drivers influence the density of small organisms, they do not affect larger organisms, which may explain why the slope of size spectra remains consistent. These findings underscore the critical influence of temperature on aquatic community dynamics and stress the significance of cross-ecosystem resource subsidies in sustaining food webs under warming.

Leaf decomposition under stress: hydrological extremes and pesticide contaminated litter along the aquatic–terrestrial continuum

Aida Viza[1]*, Christiane Baschien[2,3], Carsten A. Brühl[1], Tom Dekker[1], Alexander Feckler[1], Tiare Huízar[1], Ralf Schulz[1], Mirco Bundschuh[1]

[1]RPTU University Kaiserslautern-Landau, Department of Natural and Environmental Sciences, iES Landau, Institute for Environmental Sciences, Fortstraße 7, Landau 76829, Germany. [2]Institute of Microbiology, Technische Universität Braunschweig, Brunswick, Germany. [3]Leibniz Institute, DSMZ-German Collection of Microorganisms and Cell Cultures, Brunswick, Germany

aida.viza@rptu.de

Freshwater and adjacent terrestrial systems are tightly coupled through reciprocal subsidies. Global change drivers, such as chemical pollution and altered hydrological regimes, can propagate across system boundaries and affect key ecosystem processes, including plant litter decomposition. Although decomposition is a fundamental component of ecosystem functioning across systems, it is often studied separately in aquatic and terrestrial habitats. We conducted a mesocosm experiment to examine how contrasting hydrological events (drying and flooding) and pollution associated with leaf litter from human-impacted and non-impacted sites influence decomposition and associated communities (invertebrates and microbes) along the aquatic– terrestrial continuum. To reflect environmentally realistic conditions, leaf litter was collected from forested and agricultural sites. The 25-day experiment comprised four phases: conditioning (10 days), drying (5 days), flooding (5 days), and recovery (5 days). Litter was exposed to drying and flooding, individually and in combination, at three positions perpendicular to stream flow: within the streambed (0 m), on the shoreline (0.5 m), and in the riparian zone (5 m). Preliminary analyses show that habitat position, drying, and pesticide contamination of litter significantly affect decomposition rates, whereas flooding affected only microbially mediated decomposition, suggesting a limited invertebrate contribution on flooded shorelines. Ongoing work will characterise microbial (fungal and bacterial) and invertebrate communities, and pesticide concentrations will also be analysed. Outcomes are expected to provide new insights into how global change stressors alter cross-boundary ecosystem functioning, addressing key knowledge gaps in meta-ecosystem research.

Limnología de las lagunas españolas

Miguel Alonso

Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Universitat de Barcelona

malonso@ub.edu

En la península ibérica, las lagunas y las charcas son los ecosistemas lénticos más abundantes y diversos. Debido a la elevada heterogeneidad litológica y climática del territorio, la limnología de estas aguas de pequeño volumen es particularmente rica y variada. Los estudios llevados a cabo en este país se iniciaron en 1976, incluyeron más de 2.000 cuerpos de agua y se enfocaron a tipificar las lagunas en función de parámetros ambientales y a la naturaleza de su biota. Los parámetros que mejor explican los cambios en las comunidades de crustáceos son la mineralización, la turbiedad y la temporalidad. La mineralización es muy importante y es necesario, dentro de cada clase (dulce, intermedia y elevada), conocer las proporciones iónicas. La turbiedad que interesa es la debida a sólidos inorgánicos en suspensión, principalmente arcillas. Y la temporalidad depende del balance de entradas y salidas en la cubeta y de la profundidad de esta. De todos los organismos acuáticos estudiados, los más relacionados con los parámetros mencionados son los crustáceos: Branquiópodos (104 taxones) y Copépodos (40 taxones). Se han definido 22 comunidades trabajando con afinidades faunísticas. En relación con la mineralización se pueden distinguir tres tipos de organismos: los de agua dulce, los de agua mineralizada y los de agua hipersalina. En relación con la turbiedad hay diferentes adaptaciones relacionadas con la alimentación, la radiación de onda corta, y la pigmentación del cuerpo. Y en relación con la temporalidad, la capacidad de sobrevivir al periodo seco, la adaptación a grandes fluctuaciones ambientales y la adaptación a periodos húmedos de duración imprevisible. Después de estudiar con mucho detalle las lagunas españolas, en 2005 se inició una campaña a Mongolia, un país climáticamente muy diferente, pero con geomorfología similar a la ibérica. Las lagunas muy numerosas, similares y sobre todo prístinas, tenían interés para compararlas con las ibéricas. Posteriormente, hasta el año 2019 se llegaron a muestrear 1.285 cuerpos de agua.

Zooplankton in the Albufera of Valencia lagoon: main changes observed following the major flood of October 2024

Javier Armengol*, Daniel Espinoza, Antonio Picazo, Antonio Camacho, Andreu Rico

Institut Cavanilles de Biodiversitat i Biologia Evolutiva, Universitat de València, C/ Catedràtic José Beltrán Martinez 2, 46980 Paterna (València), Spain

Javier.Armengol@uv.es

In October 2024, flash floods from the Magro River and the ravine system of the Poio-Poçalet- Torrent basin discharged approximately 120 hm^3 into the Albufera marshes and lagoon within a few hours. These floods, which had previously affected extensive urban areas and caused severe material and human losses, including sanitation infrastructures and wastewater treatment plants. With the flood, huge amounts of water and sediment were introduced into the wetland surrounding the lagoon, which acted to mitigate the flood and reduce its effects on nearby urban areas. In addition, the floodwaters carried enormous quantities of solid and liquid waste with varying degrees of impact and potential toxicity. L'Albufera de Valencia is an hypertrophic large shallow oligohaline lagoon located on the eastern Mediterranean coast of Spain. There are several densely populated cities in the surrounding area, resulting in significant agricultural and industrial activity near the lake. During the flood, the depth of the lake increased by approximately one meter, doubling its habitual depth. The objective of this study is to characterize the main changes observed in zooplankton during the year following the flood; is part of a broader limnological study, funded by the Valencian Regional Government, which aims to investigate the effects of that flood on the ecosystem as a whole. The results show that, following a significant decline in zooplankton density and richness (less than 50 ind/l and 7 species), and after notable fluctuations, the populations returned to their usual levels within a few months, with rotifers and copepods dominating in density (>1,000 ind/l). A PCA reveals marked seasonal differences and highlights samples taken close to the time of the flood, while also showing similarities among sampling points. Cladocerans wich increased its richness (including some exotic species) and densities, becoming dominant in terms of biomass at certain points in the annual cycle.

Environmental filtering and spatial patterns of prokaryotic diversity in remote steppe Mongolian lakes

Antonio Camacho[1]*, Antonio Picazo[1], Manuel Toro[2], Miguel Alonso[3]

[1]Instituto Cavanilles de Biodiversidad y Biologia Evolutiva. Universitat de València. [2]Centro de Estudios Hidrográficos del CEDEX. [3]Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Universitat de Barcelona

antonio.camacho@uv.es

Remote endorheic lakes in the Mongolian steppe represent unique ecosystems for studying microbial biogeography due to their extreme environmental gradients and, in most cases, minimal anthropogenic impact. They have strong differences in salinity, altitude, and trophic status. This study, paying tribute to Miguel Alonso, investigates the microbial community structure and diversity across 45 Mongolian lakes, aiming to identify the ecological drivers that govern microbial assembly in these vulnerable Central Asian aquatic systems. Environmental parameters, including pH, conductivity, turbidity, altitude, and lake area, were measured in situ. Total DNA was extracted from samples and microbial communities were characterized via high- throughput sequencing of the 16S rRNA gene (V4 region, 515f/806r primers) using the Illumina MiSeq platform. Bioinformatic processing was conducted through the UPARSE pipeline, clustering sequences into zero-radius Operational Taxonomic Units. Taxonomic assignment was performed with SILVA 138.2 database. Additionally, Indicator Value (IndVal) analysis was employed to identify specific marker taxa associated with contrasting environmental conditions. The analysis of microbial diversity and community structure revealed that assembly patterns were significantly shaped by environmental filtering. Salinity emerged as the primary environmental driver of community composition, though significant correlations were also found with trophic status and turbidity. The study also assessed the presence of potential pathogenic taxa, suggesting critical implications for water safety and ecosystem health in regions dependent on these resources. Our findings demonstrate that microbial distribution in Mongolian lakes was primarily governed by the strong salinity (conductivity) gradient though a marked biogeographical signal linked to the province of origin also appeared. These results highlight that both local hydrochemistry and regional spatial factors are essential for predicting microbial responses to environmental change in semi-arid steppe ecosystems around the world.

Parasite sedimentary DNA reveals historical fish introductions in a lake of the Pyrenees: a comparison with cladoceran remains

Jordi Catalan[1,2]*, Elena Fagín[2], Anton Brancelj[3], Pere Masqué[4], Marisol Felip[5,2]

[1]CSIC, [2]CSIC, [3]National Institute of Biology, Slovenia, [4]Edith Cowan University, [5]Universitat de Barcelona

j.catalan@creaf.uab.cat

Alien fish introductions in lakes and rivers have been one of the most significant human manipulations of freshwater ecosystems since historical times. Ancient environmental DNA from lake sediments (sedDNA) can provide evidence of their chronology and impacts. However, for several reasons, direct detection of fish DNA fingerprints might not always be easy. Alternatively, most natural fish populations harbor a collection of ectoparasites that eventually diffuse into the water column and can provide a regular, spatially consistent signature in the sediments. High-mountain lakes were historically fishless due to natural barriers. Although particularly intensive in the last decades, historical documents indicate that introductions began much earlier in the European high mountains. In Lake Redon (Pyrenees), fish parasites of different clades were detected as early as the 7th century using the 18S rRNA gene. *Ichthyobodo* (Kinetoplastea) was of particular interest due to its consistent occurrence. The initial introduction coincides with extensive Late-Roman and Visigothic mountain use for sheep pasturing, supported by nearby archaeological remains and increased primary lake production, as evidenced by photosynthetic pigments. Changes in cladoceran composition and body size have been a traditional approach to assessing fish introductions. However, they are not preferred prey for fish, so other factors (e.g., climate and eutrophication) can induce confounding patterns. In this case study, climate fluctuations and human effects on external nutrient loadings appear more relevant than fish in impacting the lake food web, as far as it can be evaluated using cladoceran remains. Using parasites' DNA provides an independent proxy for evaluating fish impacts on aquatic ecosystems, avoiding the circularity inherent in using changes in their prey.

Un visionario de la directiva marco del agua

Concha Durán[1]*, Miriam Pardos[2]

[1]Confederación Hidrográfica del Júcar, 46010, Valencia, España. [2]Confederación Hidrográfica del Ebro, 46010, Valencia, España

mariaconcepcion.duran@chj.es

El 22 de diciembre del 2025 se celebró el 25 aniversario de la publicación de la Directiva Marco del Agua, que supuso un antes y un después en el seguimiento de la calidad de las aguas en Europa. Adelantándose a los tiempos, en 1998, el Estudio de la calidad ecológica integral del río Ebro fue realizado por Miguel a través de Limnos para la Confederación Hidrográfica del Ebro. Este estudio tuvo como objetivo principal la realización de un diagnóstico de la calidad ecológica integral del eje del río Ebro, mediante un análisis espacial en continuo, desde su nacimiento hasta la desembocadura en el Mediterráneo. La metodología utilizada fue novedosa, ya que evaluó la calidad medioambiental del río, a partir de las observaciones realizadas en el recorrido completo del río; de esta forma las evaluaciones corresponden a tramos fluviales y no a puntos discretos (estaciones de muestreo en los sistemas de control ambiental tradicionales). Esto precisó la definición de una metodología específica y propia, que dejaba entrever lo que terminaría siendo la metodología de trabajo de las Confederaciones Hidrográficas y las agencias del agua para el seguimiento del estado de las aguas. El trabajo proporcionó un diagnóstico integral y detallado de la situación en 1998 y una previsión de futuro del ecosistema fluvial del Ebro. Este trabajo, llevado a cabo dos años antes de la aprobación de la directiva marco del agua, constituyó un hito en la evaluación de la calidad medioambiental de un río, y más especialmente un río tan emblemático como el Ebro, cuya Confederación está celebrando sus 100 años de existencia en este 2026.

Is *Leucocythere* an ostracod genus from deep or from shallow steppic lakes? Description of a new specie from La Mancha and comparison with related species

Francesc Mesquita-Joanes[1]*, Josep Antoni Aguilar-Alberola[1], Koen Martens[2]

[1]Institut Cavanilles de Biodiversitat i Biologia Evolutiva, University of Valencia Catedrático José Beltrán Martínez, 2, 46980 Paterna, Spain. [2]Royal Belgian Institute of Natural Sciences, Freshwater Biology, Vautierstraat 29, B-1000 Brussels, Belgium

mezquita@uv.es

The non-marine ostracod genus *Leucocythere* is at present considered to be composed of only four extant species. Two of them have Eurasian distributions: *L. mirabilis*, mainly in Europe, and *L. dorsotuberosa* in Asia. The other two are present in Africa: *L. algeriensis* in Northern Africa, *L. helenae* in South Africa. In the present work, we describe a new species, *L. miracleae* n. sp. from a shallow temporary lake in central Spain. Its carapace shape is similar to the type species *L. mirabilis*, but it differs from it in the absence of long pseudochaetae on the male third thoracopod, and in the length of the male copulatory f2 seta (long in the new species, short in the type species). Further differences in the copulatory organ and shell morphology differentiate it from other species of the genus. We also detail the morphology of *L. mirabilis* and *L. algeriensis* based on individuals collected in new localities from Spain and Morocco, respectively, and stress their differences with respect to the original descriptions, which suggest some intraspecific variability among localities, probably related to reduced genetic flow among populations. In the light of these new collections, all of them from shallow, warm and temporary habitats, we discuss the already challenged view of *Leucocythere* (and *L. mirabilis* in particular) as a cold stenotherm ostracod typical of deep lakes, and therefore confirm the adaptation of the group to temporary waters in dry areas

Shaping a limnology group: the scientific and human legacy of Miguel Alonso

Montserrat Real*, Jordi Noguero, Isabel Miró, Pau Torrents, Ana García, David Vernis, Elísabeth Fernández, Elvira Romans, Jordi Cirera

AECOM Spain DCS, S.L., 08010, Barcelona, Spain

montserrat.real@aecom.com

Miguel Alonso has played a decisive and long-lasting role in shaping the scientific direction, working culture, and professional development of our limnology group. With nearly five decades of experience in freshwater ecology, he has consistently united academic depth with applied environmental management, creating an environment where rigorous science and practical implementation naturally reinforce one another. His expertise in the ecology of wetlands, lakes, reservoirs, and rivers—combined with his strong background in taxonomy and the study of freshwater crustaceans—has provided our team with a robust conceptual and methodological foundation. As a manager, Miguel fostered a coordinated and multidisciplinary way of working. He contributed to the development of integrated approaches for ecological diagnosis, monitoring design, and restoration planning in inland waters impacted by anthropogenic pressures. His leadership emphasized rigorous field observation, critical analysis, and the effective integration of biological indicators into environmental decision making. Under his guidance, our group strengthened its ability to collaborate with public administrations, environmental agencies, and private companies, reinforcing the link between scientific evidence and practical water management solutions. As a mentor, Miguel encouraged intellectual curiosity, methodological rigor, and continuous learning. He sup- ported the development of individual expertise while nurturing a shared scientific identity, promoting participation in conferences, scientific societies, and collaborative projects. Many of our current research lines—ranging from ecological assessment of freshwater ecosystems through quality indicators to studies on ecosystem structure, functioning, and applied limnology—reflect his vision of limnology as a discipline that bridges fundamental knowledge with real world challenges. This presentation will outline Miguel Alonso's key contributions as both manager and mentor, illustrating how his leadership has shaped our group's values and long-term commitment to understanding freshwater ecosystem structure and function. His influence continues to guide our work and remains a cornerstone of our collective approach to limnology.

Cuando emergen los grandes branquiópodos: cambios en los factores ambientales y las comunidades de zooplancton en las lagunas temporales de Madrid y Doñana

Marina Tomás-Martín[1]*, Carmen Díaz-Paniagua[2], Miguel Alonso[3], María Antón-Pardo[4], Christian Arnanz[1,2], Pablo Soto-García[1], Margarita Florencio[2]

[1]Departamento de Ecología, Universidad Autónoma de Madrid, C/ Darwin 2, Madrid, Spain. [2]Estación Biológica de Doñana, Consejo Superior de Investigaciones Científicas, Av. Américo Vespucio 26, Sevilla, Spain. [3]Departamento de Biología Evolutiva, Ecología y Ciencias Ambientales, Universitat de Barcelona, Av. Diagonal 643, Barcelona, Spain. [4]Cavanilles de Biodiversidad y Biología Evolutiva, Universitat de València, Catedrático Beltrán, 2; Paterna, València, Spain

marina.tomas@uam.es

Los grandes branquiópodos (GB) son un grupo de crustáceos exclusivos de ecosistemas acuáticos temporales caracterizados por el desarrollo de estructuras de resistencia adaptadas a periodos secos. Además de su singularidad evolutiva, tienen un papel ecológico relevante en la estructura y funcionamiento de sus hábitats. El objetivo de este estudio es analizar si la presencia de GB está asociada a unas características ambientales y comunidades zooplanctónicas determinadas. Para ello se muestrearon 35 lagunas temporales en el Parque Nacional de Doñana (PND) con un alto grado de protección, y 35 en la Comunidad de Madrid (CAM), en un área caracterizada por la fragmentación de hábitats y antropización. En cada laguna se registraron datos de profundidad máxima, parámetros fisicoquímicos, concentración de clorofila-a y nutrientes inorgánicos disueltos (amonio, nitrito, nitrato y ortofosfato), cobertura de vegetación acuática y la composición específica del zooplancton. Se detectó la presencia de GB en 23 lagunas temporales (12 en PND y 11 en CAM), detectándose un total de nueve especies: *Chirocephalus diaphanus* y *Tanymastix stagnalis* en ambas regiones; *Streptocephalus torvicornis*, *Branchipus cortesi*, *Cyzicus grubei*, *Magrebestheria maroccana* y *Triops baeticus* exclusivamente en Doñana; y *Branchipus schaefferi* y *Triops cancriformis* únicamente en Madrid. Las lagunas con presencia de GB fueron más turbias y someras, y presentaron menor cobertura de vegetación acuática y menor conductividad eléctrica que aquellas donde los GB no estuvieron presentes, en ambas regiones. Además, se detectaron diferencias significativas en la composición de las comunidades del zooplancton entre lagunas con y sin GB. En ambas regiones, el copépodo *Mixodiaptomus incrassatus* fue dominante en lagunas con GB, mientras que los cladóceros *Simocephalus vetulus* y *Daphnia magna* predominaron en lagunas sin GB. Estos resultados muestran que, pese a la diferencia de hábitats y del grado de antropización entre ambas regiones, las lagunas temporales con GB comparten unas características ambientales y comunidades zooplanctónicas singulares.

A new water flea *Daphnia mariae* (Branchiopoda: Diplostraca) from South America

Miguel Alonso[1], Marc Ventura[2]*

[1]Faculty of Biology, University of Barcelona, 08028, Barcelona, Cataluña, España. [2]Centro de Estudios Avanzados de Blanes, CSIC, 17300, Blanes, Cataluña, España

ventura@ceab.csic.es

Daphnia mariae, a new species, has been found in a small temporary lake in northern Chile. This species is morphologically and genetically close to *D. peruviana* Harding, 1955, discovered in mountain ponds in southern Peru. Both species are large sized, belong to the subgenus *Daphnia* and, so far, are exclusive to South America. Morphological descriptions and differential diagnosis are given for the two species. Diagnostic traits differentiating *D. mariae* sp. nov. from *D. peruviana* can be seen in the caudal spine of the male and female adults and juveniles, the dorsal curvature of the adult female valves, the number and thickness of teeth in the anal portion of the postabdomen and the length of the male seta of antenna I. A phylogenetic analysis with a fragment of the Cytochrome Oxidase I (COI) is also provided which confirms the morphological results. *D. mariae* and *D. peruviana* are separated by 14.5 % differentiation. The genetic analyses also showed that previous analyses of *Daphnia* from Argentina also belong to *D. mariae* indicating that the new species is distributed at least in these two countries. In addition we also provide the genetic characterisation of *Daphnia inca*, which was found in the same lagoons, and are able to redescribe other non previously known locations of the latter species.

From Birthday Creek to the World: 20 years and beyond of the GLoBE coordinated network

Luz Boyero[1,2]*, Richard Pearson[3], Javier Pérez[4], Aydeé Cornejo[5], Christopher Swan[6]

[1]Department of Plant Biology and Ecology, University of the Basque Country EHU, Leioa, Spain. [2]IKERBASQUE, Basque Foundation for Science, Bilbao, Spain. [3]Centre for Tropical Water and Aquatic Ecosystem Research (TropWATER), James Cook University, Townsville, QLD, Australia. [4]Department of Biology and Geology, University of Almería, Almería, Spain. [5]Freshwater Macroinvertebrate Laboratory, Gorgas Memorial Institute for Health Studies (COZEM-ICGES), Panama City, Panama. [6]Department of Geography and Environmental Systems, University of Maryland, Baltimore County, Baltimore, MD.

luz.boyero@ehu.eus

Coordinated research networks are an increasingly adopted approach to addressing global ecological questions concerning, for example, climate change, biodiversity loss, and habitat degradation. The GLoBE ('Global Lotic Breakdown Experiments') network was conceived in 2006 while sampling at Birthday Creek (in the Australian wet tropics), with the aim of revealing major patterns and drivers of stream ecosystem functioning and biodiversity. While existing evidence pointed to critical differences between temperate and tropical streams, studies were sparse and geographically biased. Therefore, we joined forces with multiple researchers around the world (40+) and conducted coordinated experiments that established some global trends and future projections. Among our findings was the increasing relative role of microbial decomposers vs. invertebrate consumers (detritivores) towards warmer climates, with substantial reductions in detritivore numbers and diversity, and leaf-litter quality. Furthermore, we identified the existence of different mechanisms regulating diversity-ecosystem functioning relationships at different latitudes, with potentially greater impacts of losing riparian plant diversity and detritivore diversity on decomposition rates in the tropics. At present, we are exploring the consequences of the interaction between major land-use changes in catchments (tree monoculture plantations, agricultural activities, and urban settlements) and latitude on decomposition rates and associated invertebrate assemblages.

20 years of advancing team science with the Global Lake Ecological Observatory Network (GLEON)

Rafael Marcé[1]*, Lisette de Senerpont-Domis[2]

[1]Centre d'Estudis Avançats de Blanes (CEAB-CSIC), Blanes, Espanya. [2]Netherlands Institute of Ecology (NIOO-KNAW), Wageningen, The Netherlands

rmarce@ceab.csic.es

Over the past two decades, the Global Lake Ecological Observatory Network (GLEON) has transformed the way lake science is conducted by pioneering a model of open, international, and highly collaborative research. Established as a grassroots community of limnologists, ecologists, engineers, data scientists, and practitioners, GLEON set out to address a central challenge in freshwater science: understanding and predicting lake dynamics and benefits at temporal and spatial scales that exceed the capacity of individual researchers or institutions. In this talk, we will walk you through the history of GLEON and its transformation from a technology-focused to a community-driven initiative that works towards a more inclusive and diverse science. We will also explain how we navigated the COVID 19 pandemic without halting activity and will share the lessons we learnt about virtual meetings and the unexpected opportunities for inclusiveness they harbour. Finally, we will showcase some examples of our team science methodologies and products, which stress the obvious: we go further when we collaborate.

EUROPONDS - the 3rd Fresh Project, a collaborative study of ponds across Europe

Biljana Rimcheska[1]*, Ana Balibrea[2], Luca Bonacina[3], Tamás Bozóki[4], Maria Calderó Pascual[5], Alba Camacho Santamans[6], Anna Camacho-Santamans[6], Fernando Chaguaceda[7], Teofana Chonova[8], David Cunillera-Montcusi[9], Dawid Dąbrowski[10], Alice Dalla Vecchia[11], Valentin Dinu[12], Emma Drohan[5], Constanze Englisch[13], Julie C. Fahy[14], Judit Fekete[15], Encarnación Fenoy[16], Zeus Freixinos[17], Jorge García-Girón[18], Remi Gerber[19], Mercedes Guerrero Brotons[17], Aleksandra Haba[20], Dariusz Halabowski[2]1, Jorge Henriques[22] , Ellinor Jakobsson[7], Noel Juvigny-Khenafou[23], Vojtěch Kolář[24,25], Katarzyna Kuczyńska[20], Frederic Labat[19], Alfredo Llorente[26,27], Pierre Marle[28], Joana Martelo[29], Margaux Mathieu- Resuge[30,31], Benjamin Misteli[19], Rhiannon Mondav[7], Daniel Morant[6], Simone Moras[7], Maria Iasmina Moza[32], Karla Münzner[7], Liam Nash[33], Veronica Nava[3], Darmina Nita[32], Adriana Olenici[32], Stephen Esosa Osakpolor[23], Tarn Preet Parmar[34], Pietro Maria Rontani[11], Juan Rubio-Ríos[16], Martin Sarkezi[13], Alberto Scotti[35], Pablo Soto García[36], Martin Souto[2], Agnieszka Sowa[37], Olivera Stamenkovi[38], Ena L. Suarez[28], Pablo Timoner[28], Pietro Tirozzi[3], Marina Tomás Martín[36], Francesca Vallefuoco[39,40], Magdalena Vanek[35], Lucie Vebrová[24], Jose Manuel Zamora Marín[41], Marta Zawadzka[10], Lena Fehlinger[30,42,43]

[1]Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences; 1 Tsar Osvoboditel Blvd., 1000 Sofia, BULGARIA [2]CIBIO, Research Center in Biodiversity and Genetic Resources, InBIO Associate Laboratory, Faculty of Sciences and Technology, University of the Azores; Rua da Mãe de Deus, 9500-321 Ponta Delgada, Açores, PORTUGAL [3]Department of Earth and Environmental Sciences, University of Milano-Bicocca; Piazza della Scienza 1, 20126, Milano, ITALY [4]Institute of Biology, University of Pécs; H-7624 Pécs, Ifjúság útja 6. HUNGARY [5]Dundalk Institute of Technology, Centre for Freshwater and Environmental Studies, Marshes Upper, Dundalk, Co. Louth, IRELAND A91 K584 [6]Cavanilles Institute for Biodiversity and Evolutionary Biology; Parque científico-Entrada lateral Calle del Catedrático José Beltrán Martínez, 2, 46980, Paterna, Valencia, SPAIN [7]Department of Ecology and Genetics, Uppsala University; Norbyvägen 18 D, 752 36, Uppsala, SWEDEN [8]INRAE, UMR CARRTEL, Thonon-les-bains, F-74200, FRANCE [9]FEHM-Lab. Section of Ecology, Department of Evolutionary Biology, Ecology and Environmental Sciences. University of Barcelona, Diagonal, 643, 08028 Barcelona, CATALONIA/SPAIN [10]University of Warmia and Mazury in Olsztyn; Michała Oczapowskiego 2 10-719 Olsztyn, POLAND [11]Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma; Str. dell'Università, 12, 43121 Parma PR, ITALY [12]Research Center in Systems Ecology and Sustainability, University of Bucharest, Splaiul Independentei 91-95, 050095, Bucharest, ROMANIA [13]Functional and Evolutionary Ecology, Faculty of Life Sciences, University of Vienna, 1090 Vienna, AUSTRIA [14]EISA, University of Applied Sciences and Arts Western Switzerland; HEPIA, Route de Presinge 150, CH-1254 Jussy, SWITZERLAND [15]University of Pannonia, Centre of Natural Science, Research Group of Limnology and Centre for Ecological Research, Institute of Aquatic Ecology, Department of Tisza Research, HUNGARY [16]Department of Biology and Geology, University of Almeria; Ctra. Sacramento s/n. La Cañada de San Urbano, 04120 Almería, SPAIN [17]Department of Ecology and Hydrology, Faculty of Biology, Campus de Espinardo, University of Murcia, SPAIN [18]Finnish Environment Institute, Freshwater Centre, P.O. Box 413, FI-90014 Oulu, FINLAND [19]Université Rennes 1 - UMR 6553 CNRS ECOBIO; Campus de Beaulieu, 263 avenue du Général Leclerc, 35042 Rennes Cedex, FRANCE [20]Institute of Biology, Department of Hydrobiology, University of Szczecin; Wąska 13, 71- 415 Szczecin, POLAND [21]Institute of Biology, Biotechnology and Environmental Protection, Faculty of Natural Sciences, University of Silesia in Katowice; Bankowa 9, 40-007 Katowice, POLAND [22]Centre for Ecology, Evolution and Environmental Changes, Faculty of Sciences, University of Lisbon; Bloco C2, Campo Grande, 1749-016 Lisbon, PORTUGAL [23]iES - Institute for Environmental Sciences, University Koblenz-Landau, Fortstraße 7, 76829 Landau i. d. Pfalz, GERMANY [24]Faculty of Science, University of South Bohemia; Branisovska 1760, Ceske Budejovice, CZ-37005, CZECH REPUBLIC [25]Institute of Entomology,

Biology Centre, Czech Academy of Sciences; Branisovska 31/1160, Ceske Budejovice, CZ-370052, CZECH REPUBLIC [26]Anbiotek s.l., Ribera de Axpe, 11 B-201, 48950 Erandio, Bizkaia, SPAIN [27]Department of Plant Biology and Ecology, University of Basque Country; SPAIN [28]Department F.-A. Forel for environmental and aquatic sciences, University of Geneva; Uni Carl Vogt - 66, Boulevard Carl-Vogt, CH-1211 Genève 4, SWITZERLAND [29]Marine and Environmental Sciences Centre, Faculty of Sciences, University of Lisbon, 1749-016 Lisbon, PORTUGAL [30]WasserCluster Lunz - Biologische Station GmbH; Dr Carl Kupelwieser Promenade 5, A- 3293 Lunz am See, AUSTRIA [31]Univ Brest, CNRS, IRD, Ifremer, LEMAR, F-29280, Plouzane, FRANCE [32]Research Center for Ecological Services, University of Bucharest; Spl Independentei 91- 95, 050089, Bucharest, ROMANIA [33]School of Biological and Chemical Sciences, Queen Mary University of London; Mile End Rd, Bethnal Green, London E1 4NS, UNITED KINGDOM [34]Limnological Institute, University of Konstanz; Mainaustraße 252, 78464 Konstanz, GERMANY [35]Institute for Alpine Environment, EURAC Research; Viale Druso 1, 391000 Bolzano, ITALY [36]Department of Ecology, Universidad Autonoma de Madrid; Calle Darwin, 2, 28049 Madrid, SPAIN [37]Department of Invertebrate Zoology and Hydrobiology, Faculty of Biology and Environmental Protection, University of Łódź, Banacha 12/16, 90-237 Łódź, POLAND [38]Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš; Višegradska 33, 18000 Niš, SERBIA [39]Research and Innovation Centre, Fondazione Edmund Mach, Via E. Mach 1, I-38098 San Michele all'Adige, ITALY [40]Department of Civil, Environmental and Mechanical Engineering, University of Trento, I- 38123 Trento, ITALY [41]Department of Zoology and Physical Anthropology, Faculty of Biology, Campus de Espinardo, University of Murcia, SPAIN [42]Danube University Krems; Dr.-Karl-Dorrek-Straße 30, 3500 Krems an der Donau, AUSTRIA [43]Fundació Bionexus, Girona, SPAIN

rimceska@gmail.com

As the 3rd Fresh Project, funded by several federate national societies of the EFFS (European Federation for Freshwater Sciences), and awarded by the EFFS, European Fresh and Young Researchers and the Fresh Blood for Freshwater initiative, EUROPONDS is a collaborative project bringing together over 70 Early Career Researchers (ECR) from 19 European countries. The project kicked off during Covid-19 circumstances in 2020, and officially ended in 2022, however, collaboration continues until the present year of 2026. With the aim to investigate emerging insect fluxes from permanent ponds to their adjacent terrestrial environment, and assessing the environmental parameters that influence said fluxes, in a collaborative effort all teams sampled their selected ponds in four seasons during an entire year. This effort allowed to sample a large geographical gradient, from Sweden to Spain, and from Poland to the Azores, which provided an unprecedented opportunity to create a dataset that was much larger than any individual ECR could have put together on their own, particularly in the early stages of developing a career in science. Integrating samples from over 55 ponds, the shared work process continued in data analysis and writing phases, with all benefits and challenges that come with having a large network of people cooperating across large distances. Particularly, we will speak about the process of collaborative writing of manuscripts. Within this presentation, we aim to share the highlights and pitfalls we experienced over the course of several years of joined teamwork alliance: the networking opportunities, pandemic challenges, how strangers can become close colleagues, deepening scientific research cooperation, and the advantages of working with people from different backgrounds, both professional and cultural.

Quantifying multiple stressor impacts on the functioning of Iberian streams: evidence from the Iberian River Observatory (iberrios)

Juan Rubio-Ríos[1]*, Pedro Abellán[2], Meritxell Abril Cuevas[3], Paloma Alcorlo[4], Bia Almeida[5], Rebeca Arias-Real[6], Paula Arribas[7], Xavi Benito[8], Saúl Blanco[9], Dani Boix[10], Núria Bonada[11], Daniel Bruno[12], Núria Catalán[13], J. Jesús Casas[14], Miriam Colls[15], Miguel Conesa[1]6, Cristina Delgado[17], Manuel Delgado-Baquerizo[18], Fernando Domínguez-Castro[19], Anna Freixa[20], Lluís Gómez Gener[21], Antonio J. García-Meseguer[22], José Luis Moreno[23], Anna Lupon[24], Andrés Mellado-Díaz[25], Pepita Nolla-Querol[26], Francisco J. Peñas[27], Félix Picazo[28], Adrián Ramos-Merchante[29], Félix Ríos[30], Enrique Valencia[31], Salomé F.P. Almeida[32], Andreas Bruder[33], Ana R. Calapez[34], Francisco Carvalho[35], Giulia Gionchetta[36], Ferran Romero[37], Rosa Gurí[38,39], Amaia A. Rodeles[40], Cristina Coccia[41], Aida Viza[42], Isabel Fernandes[43], Mario Álvarez-Cabria[27], José Antonio Carbonell[2], Christian Arnanz[4,5], Ignasi Arranz[1], José Barquín[27], Cinthya Bravo[1], Red Calore[33], Miguel Cañedo-Argüelles13, Julio Cesar López Doval[3], Nicky Chantzy[13], Ana Clara Sampaio Franco[10], Laura Concostrina-Zubiri[27], Íñigo Donázar[2], Margarita Florencio[5], Eduardo Franco-Fuentes[2], Sandra Garcés-Pastor[11], Emili García-Berthou[10], Guillermo García-Gómez[1], Alejandra Goldenberg-Vilar[27], Alexia M. González-Ferreras[27], José González[1], Diana Graça[35], Andy J. Green[5], Simone Guareschi[1], Pilar Hurtado-Aragüés[1], Carlos Jiménez[1], Maria João Feio[34], Anabel López[4], José Lourenço[35], Dunja Lukic[1], José Manuel Zamora[12], José María Fernández-Calero[11], Itxaso Martinez-Sanz[11], Carolina Mendes Muniz[10], Paula Mendoza-Casanova[8], Margarita Menéndez[11], Andrés Millán[22], Encarnación Fenoy[14,44], Salvador Mollá[4], Isabel Muñoz[11], Marc Ordeix[38,39], Giorgio Pace[35], Susana Pallarés[22], Cláudia Pascoal[35], Javier Pérez-Burillo[8], Nuria Pou-Solà[26], Lorenzo Proia[3], Eugenio Rico[4], Anna Romaní[10], Owen S. Wangensteen[11], Sergi Sabater[10], Pedro Sáez-Gómez[5], Clara Sáez[1], David Sánchez Fernández[22], Marta I. Sánchez[5], Javier Sánchez-Hernández[1], Sonia R.Q. Serra[34], Judith Solé-Bertran[26], María Soria[3], Pablo Soto-García[4], Marina Tomás-Martín[4], Rosa Trobajo[8], Josefa Velasco[22], Daniel von Schiller[11], Yang Zhao[5], Cayetano Gutiérrez-Cánovas[1]

[1]King Juan Carlos University (URJC), Madrid, Spain, [2]University of Sevilla, Sevilla, Spain, [3]BETA Technological Centre - University of Vic - Central University of Catalunya (BETA- UVIC- UCC), Vic, Spain [4]Universidad Autónoma de Madrid, Madrid, Spain [5]Doñana Biological Station (EBD-CSIC), Sevilla, Spain [6]National Museum of Natural Sciences (MNCN-CSIC), Madrid, Spain [7]The Institute of Natural Products and Agrobiology (IPNA-CSIC), La Laguna, Spain [8]Institute for Agrifood Research and Technology (IRTA), La Ràpita, Spain [9]University of León, León, Spain [10]GRECO, Institute of Aquatic Ecology, University of Girona, Girona, Spain [11]Universitat de Barcelona, Barcelona, Spain [12]University Miguel Hernández, Elche, Spain [13]FEHM-Lab, SHE2, Institute of Environmental Assessment and Water Research (IDAEA-CSIC), Barcelona, Spain [14]Andalusian Center for Global Change-Hermelindo Castro (ENGLOBA), University of Almería, Almería, Spain [15]University of the Baque Country, Bilbao, Spain [16]Odonatological Association of Andalusia, Málaga, Spain [17]University of Vigo, Vigo, Spain [18]Institute of Natural Resources and Agrobiology (IRNAS-CSIC), Sevilla, Spain [19]Pyrenean Institute of Ecology (IPE-CSIC), Zaragoza, Spain [20]Catalan Institute for Water Research (ICRA-CERCA), Girona, Spain [21]Centre for Ecological Research and Forestry Applications (CREAF), Barcelona, Spain [22]University of Murcia, Murcia, Spain [23]University of Castilla-La Mancha, Albacete, Spain [24]Center for Advanced Studies of Blanes (CEAB-CSIC), Blanes, Spain [25]Tragsatec - Water Planning and Management, Madrid, Spain [26]Phytolab Control, Barcelona, Spain [27]IHCantabria – Instituto de Hidráulica Ambiental de la Universidad de Cantabria, Santander, Spain [28]University of Granada, Granada, Spain [29]University of Huelva, Huelva, Spain [30]Cádiz Natural History Society, Cádiz, Spain [31]Complutense University of Madrid, Madrid, Spain [32]University of Aveiro, Aveiro, Portugal [33]University of Applied Sciences and Arts of Southern Switzerland, Mendrisio, Switzerland [34]MARE/ARNET & DCV, FCTUC, University of Coimbra, Coimbra, Portugal, [35]Centre of Molecular and Environmental Biology (CBMA) / Aquatic Research Network (ARNET)

Associate Laboratory, University of Minho, Braga, Portugal. [36]Institute of Environmental Assessment and Water Research (IDAEA-CSIC), Barcelona, Spain [37]Swiss centre of excellence for agricultural research, Lausanne, Switzerland [38]Centre d'Estudis dels Rius Mediterranis (CERM), Universitat de Vic – Universitat Central de Catalunya (UVic-UCC), Manlleu, Catalonia, Spain [39]Aquatic and Terrestrial Ecology Group (GEAT), Universitat de Vic - Universitat Central de Catalunya (UVic-UCC), Vic, Catalonia, Spain [40]Centro de Investigación Mariña (CIM), Universidade de Vigo, Vigo, Spain [41University] of Roma Tre, Roma, Italy [42]RPTU Kaiserslautern-Landau, Department of Natural and Environmental Sciences, iES Landau, Institute for Environmental Sciences, Landau, Germany [43]Institute of Microbiology, University of Applied Sciences and Arts of Southern Switzerland (SUPSI), Bellinzona, Switzerland [44]Estación Experimental de Zonas Áridas (EEZA), CSIC, Almería, Spain

juan.rubio@urjc.es

Global change threatens Earth's stability by altering the fluxes of energy and matter across ecosystems. Yet the consequences of an increase in multiple human-driven stressors on the functioning of ecosystems where baseline productivity is low (e.g. rivers and streams), remain poorly understood. To fill this gap, we used the site network of the Iberian River Observatory (IberRios) to gather data of a broad range of environmental stressors and ecosystem functions in stream ecosystems. Based on a two-year survey of 62 streams distributed across seven geographical regions of the Iberian Peninsula with contrasting climates, we quantified how ecosystem functioning responded to multiple stressors, including organic carbon and nutrient enrichment, riparian degradation, thermal stress, hypoxia, drying stress and chemical stress on stream functioning. To do so, we assessed the responses of a multifunctionality index, representing the ability of stream ecosystems to sustain multiple functions simultaneously, which integrated six key stream functions: primary production, microbial production, macroinvertebrate production, organic matter decomposition & nutrient cycling, respiration and pathogen control. Our results show that stream multifunctionality increased consistently with both the increasing number and intensity of environmental stressors. Multifunctionality and individual functions were generally explained through positive associations with dissolved inorganic phosphorus and organic carbon, whereas other stressors showed comparatively weaker effects. Stressors reshaped functions through compensatory trade-offs where microbially mediated processes and primary production generally increased, partially offsetting declines in macroinvertebrate production and pathogen control. Our findings indicate human impacts artificially increase overall levels of ecosystem functioning in streams, what may lead to potential negative impacts for water quality, biogeochemical stability, and biodiversity conservation. Our results suggest that higher levels of ecosystem functioning may act as a promising early-warning indicator of global change impacts, while identifying nutrients and organic matter as main drivers of functional alterations in unproductive ecosystems.

Simulating drying and human impacts on river networks to evaluate biological quality indices performance through the lens of metacommunity theory

Zeynep Ersoy[1,2,3,4], David Cunillera-Montcusí[5,6], Martí Piñero-Fernández[3,4], Miguel Cañedo- Argüelles[7], María del Mar Sánchez-Montoya[8], Núria Bonada[3,4]*, Núria Cid[9]

[1]Área de Biodiversidad y Conservación, Departamento de Biología y Geología, Física y Química Inorgánica, Universidad Rey Juan Carlos (URJC), Móstoles, Madrid, Spain [2]Instituto de Investigación en Cambio Global, Universidad Rey Juan Carlos, Móstoles, Madrid, Spain [3]FEHM-Lab (Freshwater Ecology, Hydrology and Management), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Catalonia, Spain [4]Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Catalonia, Spain [5]Institute of Aquatic Ecology, Centre for Ecological Research, Budapest, Hungary [6]IFREMER–DYNECO/LEBCO, Centre de Bretagne, CS1007 29280, Plouzané, France [7]SHE2 group (Surface Hydrology, Ecology and Erosion), Institute of Environmental Assessment and Water Research (IDAEA, CSIC), Jordi Girona, 18-26, 08034 Barcelona, Spain [8]Department of Biodiversity, Ecology, and Evolution, Faculty of Biological Sciences, Complutense University of Madrid, Spain 9 IRTA Marine and Continental Waters Programme, La Ràpita, Catalonia, Spain

bonada@ub.edu

Incorporating metacommunity perspectives into bioassessment represents a major challenge in the management of drying river networks, where drying-induced fragmentation compromises the performance of biological indices. Indeed, current indices focus on local community responses to stressors and neglect the effect of regional processes, such as spatiotemporal connectivity and dispersal, on metacommunity assembly. We explored the effect of drying on the performance of a widely used biological index using metacommunity simulations on a synthetic drying river network (DRN). We assessed how different gradients of drying-driven fragmentation and human impact extent determine local richness and the biological index scores by combining simulations with biomonitoring information. We used a coalescent metacommunity model to simulate the exchange of individuals between local communities along synthetic DRNs. These networks were subjected to different drying extent, drying intensity, and human impact extent scenarios. Additionally, we considered two major characteristics for each simulated taxon: (i) tolerance to human impacts and (ii) dispersal strategy (flying, swimming, or drifting). For each simulation, we obtained local richness and the biological index value. Then, we calculated biological index performance, which we defined as the capacity to distinguish between impacted and non-impacted sites. Finally, we tested our approach in six non-impacted European DRNs. Our results showed that low spatiotemporal connectivity consistently led to decreased local richness and low scores of the biological index. As drying extent and intensity increased, drying-induced fragmentation significantly reduced the biological index performance. For example, with a 50% increase in drying extent, index performance fell over 70% and at high drying levels, this performance dropped more than 90%. This decay followed a convex pattern, with a marked drop in performance as soon as drying appeared in the catchment. We show how simulations can be used to incorporate network fragmentation and metacommunity dynamics into biomonitoring tools to increase their efficiency.

A framework to understand functional stability in drying river networks: the STARDRY project

Rubén del Campo[1]*, Meritxell Abril[2], Miguel Cañedo-Argüelles[3], David Cunillera- Montcusí[4], Thomas Fuß[5], Kieran Khamis[6], Mark Ledger[6], Julio López Doval[2], Lorenzo Proia[2], Gabriel Singer[5], Maria Soria[2], Nicolás Valiente[7]

[1]Department of Ecology and Hydrology, University of Murcia, Campus de Espinardo, 30100, Murcia, Spain [2]BETA Technological Centre- University of Vic- Central University of Catalunya (BETA- UVIC- UCC), Carretera de Roda 70, 08500, Vic, Barcelona, Spain [3]FEHM-Lab, SHE2, IDAEA-CSIC, Carrer de Jordi Girona, 18-26, 08034, Barcelona, Spain [4]IFREMER–DYNECO/LEBCO, Centre de Bretagne, CS1007 29280, Plouzané, France [5]Department of Ecology, University of Innsbruck, Technikerstraße 25, 6020, Innsbruck, Austria [6]School of Geography, Earth and Environmental Sciences, University of Birmingham, Birmingham, UK [7]Department of Science and Agroforestry Technology and Genetics, ETSIAMB, University of Castilla-La Mancha, Albacete, Spain

rubendel.campo@um.es

Drying already affects more than 50% of the global stream network and is expected to expand under climate change, threatening the functional integrity of rivers worldwide. The functioning of fluvial ecosystems can vary over time depending on changes in environmental conditions and biological communities. In drying rivers, local communities must continuously reorganize through time in response to environmental fluctuations associated with flow cessation. At the scale of the river network, however, the ecological signature of drying becomes primarily spatial. Drying fragments the network into a shifting mosaic of terrestrial and aquatic habitats, thereby structuring the distribution of communities (e.g., through dispersal constraints) and the resources they rely on (e.g., nutrients and organic matter) across the landscape. According to the insurance hypothesis, high biodiversity—particularly high beta diversity—can stabilize ecosystem functioning through the replacement of species better suited to changing conditions, thereby maintaining essential processes despite environmental change. Drying river networks provide an invaluable natural laboratory to test how biodiversity can buffer the negative impacts of climate change (e.g. increased drying frequency, duration and extent) on the functional stability of fluvial ecosystems. Within this context, the STARDRY project investigates the biotic and abiotic mechanisms regulating functional stability in river networks at both local (reach) and regional (network) scales. We hypothesize that spatiotemporal drying patterns govern functional stability through cascading effects on environmental variability, resource availability, and community turnover. We expect that community turnover can counteract negative effects of environmental variability on functional stability. To test this hypothesis, STARDRY adopts an innovative and multidisciplinary approach that combines manipulative mesocosm experiments, field surveys across an entire river network, and spatial modelling. Ultimately, STARDRY aims to contribute to the scientific foundation for a new approach in environmental management focused on preserving the functional stability of river networks.

Terrestrial plant communities in Mediterranean non-perennial rivers: environmental factors or anthropogenic pressures?

Antonio López-Pintor[1]*, Paloma de las Heras[1], Luis Sierra[1], Celia Rosalía Campíñez[1], Judit Sánchez-Nogueras[1] , Maria Rosario Vidal-Abarca[2], Mª Luisa Suárez[2], Martí Piñero-Fernandez[3,4], Núria Bonada[3,4], Núria Cid[3,5], Maria del Mar Sánchez-Montoya[1]

[1]Department of Biodiversity, Ecology, and Evolution, Faculty of Biological Sciences, Complutense University of Madrid, Spain [2]Department of Ecology and Hydrology, University of Murcia, Campus Universitario de Espinardo, Spain [3]FEHM-Lab (Freshwater Ecology, Hydrology and Management), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Universitat de Barcelona (UB), Barcelona, Catalonia, Spain. [4]Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona (UB), Barcelona, Catalonia, Spain. [5]IRTA Marine and Continental Waters Programme, Ctra de Poble Nou Km 5.5, E43540, La Ràpita, Catalonia, Spain

anlopezp@ucm.es

Non-perennial rivers constitute the dominant fluvial ecosystems in arid and semiarid regions, such as the Mediterranean, and may represent over 50% of the world's river network length. They are highly dynamic ecosystems across space and time, shifting between aquatic and terrestrial habitats (flowing habitats, disconnected pools, dry riverbeds). Their associated terrestrial plant communities have been studied from a floristic perspective, but their ecology and interrelationships remain poorly understood; therefore, their ecological relevance is not fully recognized. This work is part of the DRY-Guadalmed project, which aims to develop advanced tools to assess the ecological status of temporary Mediterranean rivers during the dry phase and to address existing management challenges and needs. During the dry phase of 2023 and 2024, a previously developed sampling protocol for terrestrial vegetation was applied in 30 non-perennial river sites from two contrasting Mediterranean watersheds (Guadiana and Segura). In each study site, the different geomorphological units were identified, and their terrestrial vegetation sampled by estimating species cover in a semiquantitative scale. NMDS was applied to species composition, and species richness, diversity and evenness were calculated to characterise plant communities. These variables were then related to both environmental characteristics (climatic, edaphic, hydrologic) and anthropogenic pressures quantified through the MRC index and land- use structure at 3 different spatial scales. The results showed different plant communities associated with different geomorphological units along the study gradient, with floristic composition and community structural parameters showing a variable response to both environment and pressure variables depending on the watershed they belonged to. In fact, they also suggest that riparian plant communities exhibit differences associated with anthropogenic pressures in the surrounding environment, whereas plant communities present in active channels and floodplains are more closely related to the basin's hydrology.

Assessing the biological quality of disconnected pools in temporary rivers: performance and adaptation of macroinvertebrate metrics

Martí Piñero-Fernández[1,2]*, Guillermo Quevedo-Ortiz[1,2], Zeus Freixinos[3], Judit Sánchez- Nogueras[4], María del Mar Sánchez-Montoya[4], Núria Cid[5], Núria Bonada[1,2]

[1]FEHM-Lab (Freshwater Ecology, Hydrology and Management), Universitat de Barcelona, Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Spain [2]Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Spain [3]Department of Ecology and Hydrology, University of Murcia, Campus Universitario de Espinardo, Spain [4]Department of Biodiversity, Ecology, and Evolution, Faculty of Biological Sciences, Complutense University of Madrid, Calle Jose Antonio Novais, 12, 28040 Madrid, Spain [5]IRTA Marine and Continental Waters Programme, La Ràpita, Catalonia, Spain

mapinero18@ub.edu

Temporary rivers alternate between flowing and dry phases and currently represent around 60% of the global river network, a proportion expected to increase under global change. Despite their ecological importance and high biodiversity value, key questions remain regarding their functioning, management, and conservation. This is particularly relevant for disconnected pools, which are common habitats in temporary rivers during the dry phase. Benthic macroinvertebrates are widely used as bioindicators of water quality due to their sensitivity to environmental gradients and human pressures. However, their performance in disconnected pools can be affected by natural biotic and abiotic factors, such as pool size, time since disconnection, natural oxygen depletion, predation, or spatial isolation. This study aims to (1) evaluate the performance of commonly used macroinvertebrate bioassessment metrics in disconnected pools, and (2) propose methodological adaptations to improve the reliability of the macroinvertebrate community. For this purpose, one hundred disconnected pools were sampled across nine river basins on the Iberian Peninsula, covering a multi-anthropogenic stressor gradient The results showed a low performance of standardised bioassessment metrics, and that the adaptation of indices should focus on considering specific indicator species, adjusting tolerance scores or implementing predictive modelling when assessing the biological quality of disconnected pools in temporary rivers. Our study contributes to filling the management gap on the bioassessment of temporary rivers during the dry phase.

Improvement of intermittent streams' ecological status after two decades of management in a Biosphere Reserve

Abdulrahman Reyad[1]*, Pablo Rodríguez-Lozano[2], Aitor I. Garrido-Romano[1], Isabel Pardo[1]

[1]Department of Ecology and Animal Biology, Universidade de Vigo, 36310 Vigo, Spain [2]Inland-Water Ecosystems Team (I-WET), Departamento de Ecología, Universidad Autónoma de Madrid, Madrid 28049, Spain

abdulrahman.reyad@uvigo.gal

We assessed the ecological status of intermittent streams in Menorca (Balearic Islands) following two decades of River Basin Management Plans under the Water Framework Directive (WFD). Assessment was conducted using the macroinvertebrate multi-metric index INVMIB as a biological indicator, alongside with physicochemical supporting elements ($PO_4$3-, NO_3-, DO, pH). Temporal trends in these indicators were analyzed from three periods (2005–2008, 2017, and 2022–2023) and compared, while compliance with WFD ecological objectives was assessed. Results showed a temporal trend for INVMIB improvement, although not statistically significant. A causal inference model was applied to identify drivers of INVMIB, identifying that those higher values of previous year's precipitation and a reduction in PO_4^{3-} water stream concentration favored the observed improvement in the invertebrate metric. Climate emerged as the primary driver influencing benthic communities, followed by an amelioration in agricultural intensity and improved wastewater treatment. Our results indicate that benthic invertebrate communities seem to slightly recover, but further management actions may be needed to ensure that water availability is not challenged by further human demands in these intermittent streams.

Advancing ecological assessment of non-perennial rivers through terrestrial invertebrate communities

Judit Sánchez-Nogueras[1]*, Jesús Miñano[1], Zeus Freixinos[2], Guillermo Quevedo-Ortiz[3,4], Martí Piñero-Fernández[3,4], Pablo Rodríguez-Lozano[5], E López-Aguado[1], Paloma de las Heras[1], Antonio López-Pintor[1], Núria Bonada[3,4], Núria Cid[3,6], Maria del Mar Sánchez-Montoya[1]

[1]Department of Biodiversity, Ecology and Evolution, Complutense University of Madrid, 28040 Madrid, Spain [2]Department of Ecology and Hydrology, University of Murcia, 30100 Espinardo, Murcia, Spain [3]FEHM-Lab (Freshwater Ecology, Hydrology and Management), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Universitat de Barcelona (UB), Barcelona, Catalonia, Spain [4]Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona (UB), Barcelona, Catalonia, Spain [5]Inland-Water Ecosystems Team (I-WET), Departamento de Ecología, Universidad Autónoma de Madrid, Madrid, Spain [6]IRTA Marine and Continental Waters Programme, La Ràpita, Catalonia, Spain

judits03@ucm.es

Non-perennial rivers are characterized by alternating flowing and dry phases, shaping both aquatic and terrestrial communities. Despite their ecological relevance and wide distribution, they are often overlooked in scientific research and in policy frameworks such as the European Union Water Framework Directive (WFD). Consequently, there is a need to identify ecological indicators that accurately assess the ecological status of non-perennial rivers not only during the flowing phase but also during the dry phase. Dry riverbeds, in addition to riparian habitats, have been identified as key habitats that provide benefits to terrestrial invertebrates, making them key biological components of these ecosystems. However, their potential as indicators during the dry phase has only recently begun to be explored. In this study, we investigate the role of terrestrial invertebrates as potential ecological indicators during the dry phase of non-perennial rivers in Mediterranean streams of the Iberian Peninsula. To this end, pitfall traps were installed in both dry riverbeds and adjacent riparian areas across 61 temporary streams located in Mediterranean basins in Spain (Segura, Guadalquivir, Guadiana, Tajo, Júcar, Menorca and Catalan internal basins). Sampling sites were selected along a gradient of anthropogenic pressure to evaluate the responses of terrestrial invertebrate communities to different levels of human disturbance. Structural and compositional community responses were investigated by the analysis of abundance and diversity metrics as well as specific indicator taxa of different levels of pressures. Preliminary results indicate that some taxa were indicative of different levels of anthropogenic pressure with distinct responses between dry riverbed and riparian habitats. This work aims to advance the development of tools for comprehensive ecosystem monitoring and assessment in non-perennial fluvial ecosystems worldwide.

RíosChocó: Una aplicación de ciencia ciudadana para el monitoreo de ríos neotropicales altamente biodiversos y amenazados

Pau Fortuño[1,3]*, Christian Villamarín[2], Narcís Prat[3], Inty Arcos[4] Indira Black[2], Blanca Ríos- Touma[5]

[1]Centre de Recerca Ecològica i Aplicacions Forestals (CREAF). Campus Bellaterra. Universitat Autònoma de Barcelona. Edifici C, 08193, Cerdanyola del Vallès, Spain [2]Ingeniería Ambiental y Grupo de Investigación Biodiversidad, Medio Ambiente y Salud (BIOMAS), Universidad de Las Américas, Quito 170124, Ecuador. [3]Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals. Universitat de Barcelona (UB). 08028 Barcelona, Spain. Freshwater Ecology, Hydrology and Management (FEHM). [4]Fundación Imaymana & Bosque Modelo Chocó Andino, Nanegalito, Ecuador; Consorcio para el Desarrollo Sostenible de la Ecoregión Andina (CONDESAN), Quito, Ecuador. [5]Ciencias Biológicas y Ambientales (COCIBA) & Global Research and Solutions Center, Universidad San Francisco de Quito, 170901, Quito, Ecuador

p.fortuno@creaf.uab.cat

Muchos ríos neotropicales tienen una biodiversidad muy alta y poco conocida, y actualmente están enfrentando presiones como descargas directas de zonas pobladas, minería y ganadería intensiva y extensiva. Estas amenazas comprometen el desarrollo sostenible y amenazan ríos esenciales para las comunidades locales. En la Biosfera del Chocó Andino los actores locales buscan herramientas accesibles que les permitan realizar monitoreo ecológico. Con base a estas necesidades se propuso validar en campo un método simplificado de biomonitoreo y la aplicación móvil Ríos Chocó para su uso en educación ambiental y seguimiento comunitario. Se realizaron talleres que permitieron evaluar su aceptación y ajustar su implementación. El método simplificado se construyó a partir de sistemas de biomonitoreo ya desarrollados para ríos ecuatorianos, como es el protocolo CERA que incluye al ABI, QBR e IHF. Esta metodología fue validada en comparación con sistemas más detallados, basados en un mayor número de muestras y variables ambientales. Se puso especial énfasis en indicadores de impacto como oxígeno, conductividad, coliformes fecales y metales pesados. A partir de estos análisis se seleccionaron las familias más indicativas para construir un índice simplificado adaptable a una aplicación móvil. Este método permitió diferenciar entre sitios impactados y no impactados de manera similar al método más completo. Con base en estos resultados, se realizaron varios talleres de divulgación y uso de la aplicación. La comunidad usuaria incluyó estudiantes de colegio y universidad, docentes, técnicos, comunicadores y guías locales. Los talleres fortalecieron conocimientos básicos sobre parámetros hidromorfológicos y biológicos para evaluar el estado ecológico de los ríos, generaron comentarios positivos, permitieron identificar personas interesadas en continuar con el monitoreo y facilitaron la entrega de materiales para dar seguimiento al proceso. Actualmente, el sistema se sostiene principalmente gracias a la participación de colegios locales y la red de bosques-escuela de la región.

Understanding social risk perception to support flash flood adaptation: insights from Mediterranean pilot communities

Juan Miguel Rosillo-Comino[1]*, Celso García[1], Maria Soria Extremera[2], Meritxell Abril Cuevas[2], Enol Nieto[2], Lorenzo Proia[2] , Joan Lloret[3], Helena Barrufet Bravo[3], Manuel Sapiano[4], Aaron Cutajar[4], Marzio Melis[4], Marco Graziani[4], Angela Ingenio[4], Valeri Penchev[5], Shirin Shukrieva[5], Raffaele Giordano[6], Stefania Santoro[6], Virginia Rosa Coletta[6], Xavier Llort[7], Jordi Roca[7], Christos Makris[8], Yannis Androulidakis[8], Angelos Kokkinos[8], Zisis Mallios[8], Theofanis Karambas[8], Pablo Rodríguez-Lozano[9,1]

[1]GLOWATER Research Group, Universitat de les Illes Balears, Spain [2]BETA Technological Centre (UVic-UCC), Spain [3]Euroregion Pyrenees Mediterranean [4]Energy and Water Agency, Malta [5]Black Sea – Danube Association for Research and Development, Bulgaria [6]Water Research Institute – National Research Council, Bari, Italy [7]Hydrometeorological Innovative Solutions, Spain [8]Aristotle University of Thessaloniki, Greece [9]Departamento de Ecología, Universidad Autónoma de Madrid, Spain

juan-miguel.rosillo@uib.cat

Flash floods are among the most challenging natural hazards due to their rapid onset and increasing frequency, particularly in Mediterranean regions. Beyond physical exposure, social awareness and risk perception play a critical role in shaping adaptive capacity and community resilience. Within the LocAll4Flood European project, this study explores flood risk perception and social awareness across nine Mediterranean pilot areas (Greece, Italy, Malta, Bulgaria, Catalonia, and Mallorca, Spain). A total of 2,822 face-to-face surveys were conducted using a standardized questionnaire including 20 Likert-scale statements addressing hazard perception, vulnerability, institutional trust, proposed solutions, and relationships with river environments Results reveal generally low levels of perceived preparedness and limited trust in public authorities, alongside a widespread lack of knowledge regarding appropriate actions during flood events. Nevertheless, concern about flood impacts is high in several sites. Respondents show strong support for educational actions, nature-based solutions, improved urban planning, green spaces, and river restoration, while structural interventions such as dam construction or river burial remain more contested and vary across territories. The comparative analysis highlights significant differences between pilot sites, reflecting the influence of local contexts, previous experiences, and socio-environmental settings. These findings underline the importance of integrating citizen perceptions into flood risk management and adaptation strategies. This contribution emphasizes participatory approaches as a bridge between science and society, proposing education-focused actions tailored to local needs as a pathway to strengthen co-responsibility, institutional trust, and community-based adaptation to flash flood risk in Mediterranean environments.

From knowledge to engagement: lessons from citizen science project and flash flood risk stakeholder participation in freshwater research

Maria Soria*, Julio Cesar Lopez-Doval, Friederike Vogel, Lorenzo Proia, Meritxell Abril

BETA Technological Centre- University of Vic- Central University of Catalunya (BETA- UVIC- UCC), Carretera de Roda 70, 08500, Vic, Barcelona, Spain

maria.soria.extremera@uvic.cat

Bridging science and society is a central challenge in contemporary limnology, particularly in freshwater ecosystems increasingly affected by climate change and human impacts. Participatory approaches in these contexts—such as citizen science initiatives, educational programs, and multi-stakeholder co-creation workshops—can enhance knowledge, awareness, and engagement, but may also surface emotional tensions when participants confront environmental degradation and risk. This contribution integrates evidence from two complementary initiatives linking limnological research with society. First, the Plastic Pirates citizen science project engaged secondary school students in river plastic monitoring in Catalonia (Spain). Emotional dimensions— including eco-anxiety, eco-guilt, and ecological grief—were assessed before and after educational sessions and field activities addressing plastic pollution in local rivers to evaluate whether participation reinforced students' sense of agency or intensified emotional responses. The study involved 4th-year secondary students from ten schools, assessing changes in responses before and after the intervention. Second, the LocAll4Flood project addressed flash flood risk across Mediterranean regions including Spain (Mallorca and Catalonia), Malta, Italy, Bulgaria, and Greece, through co- creation workshops involving local and regional authorities and civil protection services, members of the general public and civil society representatives, the private sector, and researchers. By integrating early warning systems, risk perception surveys, the creation of quick reference and awareness materials, and discussions on Nature-Based Solutions, the project fostered shared understanding, participatory governance, and awareness of flood risk in high- risk catchments. Across both cases, results suggest that participatory approaches in freshwater contexts can strengthen environmental knowledge, agency, and engagement, while highlighting the importance of integrating emotional literacy and structured reflection mechanisms to safeguard participant well-being. These insights provide practical guidance for designing citizen science and stakeholder participation initiatives that effectively bridge science and society in limnology.

AQUANOCER: Diving into the public knowledge and perception of freshwater ecosystems across the Iberian Peninsula

Marina Tomás-Martín[1]*, Alba Camacho-Santamans[2], Gabriela Córdoba-Ariza[3], Janine Pereira da Silva[4], Jose María Fernández-Calero[5,6], Fernanda Gonzalez-Saldias[5], Nieves López-Rodríguez[5], Itxaso Martinez-Sanz[7], Paula Mendoza-Casanova[8,9], Waren Meredith[3], Martí Piñero-Fernandez[5,6], Manuel Pinilla-Rosa[7], Guillermo Quevedo-Ortiz[5,6], Sofía Rodríguez-Gómez[10], Carlota Sánchez-Campaña[5,6], Serena Sgarzi[11,12], Irene Tornero[13], Juliana Barros[4]

[1]Departamento de Ecología, Facultad de Ciencias, Universidad Autónoma de Madrid, C/ Darwin, 2, Madrid, Spain; [2]Institut de Recerca de l'Aigua (IdRA), Universitat de Barcelona, Av. Diagonal, 643, Barcelona, Spain; [3]Institut Català de Recerca de l'Aigua (ICRA), C/ Emili Grahit, 101, Girona, Spain; [4]MARE - Marine and Environmental Sciences Centre & ARNET - Aquatic Research Network, Departamento de Ciências da Vida, Faculdade de Ciências e Tecnologias, CC Martim de Freitas, 3000-456 Coimbra, Portugal; [5]FEHM-Lab (Freshwater Ecology, Hydrology and Management), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Universitat de Barcelona, Diagonal 643, 08028 Barcelona, Spain; [6]Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona, Diagonal 643, 08028 Barcelona, Spain; [7]Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Universitat de Barcelona, Diagonal 643, Barcelona, Spain; [8]Institute of Agrifood Research and Technology (IRTA), Carretera de Poble Nou, km 5,5, La Ràpita, Tarragona, Spain; [9]Departament de Geografia, Universitat Rovira i Virgili, C/ de Joanot Martorell, 15, Vila-seca, Tarragona, Spain; [10]Departamento de Ecología y Geología, Universidad de Málaga, Blvr. Louis Pasteur, 31, Teatinos-Universidad, Málaga, Spain; [11]Grupo de Ecologia Aquàtica, Departament de Biociències, Universitat de Vic - Universitat Central de Catalunya, Carrer de la Laura 13, Vic, Barcelona, Spain; [12]Fundació Privada Bionexus, Girona, Spain; [13]Departamento de Zoología, Facultad de Biología, Universidad de Sevilla, Av. de la Reina Mercedes, 6, Sevilla, Spain

marina.tomas@uam.es

Freshwater ecosystems provide essential ecological functions and ecosystem services, including biodiversity support, water regulation, and cultural and recreational benefits. However, these ecosystems are often undervalued and poorly understood by the general public. AQUANOCER is a collaborative initiative that emerged from the XI Intermeeting Course organized by the Youth Section of the Iberian Association of Limnology (J-AIL), held in Coimbra (Portugal) in November 2025. The project aims to assess the public knowledge and perception of Iberian freshwater ecosystems, with the broader goal of strengthening the connection between society and limnology. To date, research on the social awareness of freshwater ecosystems in the Iberian Peninsula remains limited and spatially fragmented. Studies have mainly focused on invasive species, specific types of water bodies (e.g., urban permanent rivers), or stakeholder groups linked to particular activities (e.g., farmers, anglers, or local communities). Consequently, there is a lack of comprehensive assessments examining public perception across different freshwater ecosystems and socio-demographic groups at a large-scale. AQUANOCER aims to address this gap by conducting a large-scale survey targeting the general public across Spain and Portugal. Through questionnaires distributed both online and in person, the project will evaluate levels of knowledge, attitude, and perception toward freshwater ecosystems, as well as perceived ecosystem services and threats. We hypothesize that the general public has limited awareness of the ecological importance of freshwater ecosystems, tending to value them for recreation and exploitation, while highly impacted water bodies can be associated with health risks.

Additionally, we expect changes in perception according to socio-demographic factors such as age, occupation, and region of residence, where individuals living in rural areas potentially show more positive perceptions of freshwater ecosystems than in urban areas. By integrating social perception into freshwater research, AQUANOCER seeks to support socially informed conservation strategies and strengthen engagement between freshwater science and society.

Metabarcoding eDNA multimarcador para biomonitorización integrada de ríos urbanos: línea base prerrestauración del sistema Piles–Peñafrancia (Asturias)

Álvaro Fueyo[1], Ruth Coya[2], Omar Sánchez[1], Noelia B. Suárez[2], María Celenza[2], Laura Miralles[2], Trinidad Pérez[2], Javier Granero-Castro[1], Yaisel J. Borrell[2]

[1]Taxus Medio Ambiente, 33006, Oviedo, Spain, [2]Universidad de Oviedo, Area de Genética, 33006, Oviedo, Spain

pelayalva@gmail.com

Los ríos urbanos concentran múltiples presiones (canalizaciones, vertidos, segmentación, invasiones, etc.), pero también son espacios prioritarios para la restauración ecológica y la adaptación climática. En este contexto, evaluar su recuperación requiere de estudios de estado base y biodiversidad prerrestauración robustos y completos. Las técnicas de biomonitreo tradicional requieren de mucho esfuerzo de muestreo e identificación. Por ello presentamos una aproximación de metabarcoding de ADN ambiental (eDNA) multimarcador para caracterizar biodiversidad y condición ecológica en tres sistemas fluviales costeros de Asturias con distinto grado de alteración: el sistema urbano Piles-Peñafrancia (PI-PF, objeto de restauración/renaturalización), el arroyo Llantada (impactado) y el río Negro (referencia regional). Se analizaron muestras de agua (eDNA) y, en PI-PF, muestras bulk de macroinvertebrados en dos años consecutivos mediante cuatro marcadores genéticos (16S, rbcL, COI y 12S), cubriendo bacterias, diatomeas, macroinvertebrados, metazoos y vertebrados. Los resultados muestran bajo solapamiento taxonómico entre marcadores, confirmando su fuerte complementariedad, pero diferencias en el número de especies detectadas según el marcador utilizado. La composición de comunidades se estructuró de forma consistente por sistema fluvial en todos los marcadores, mientras que las diferencias de diversidad alfa fueron más limitadas y dependientes del marcador. Los EQR-IBMWP derivados de macroinvertebrados en agua-eDNA reprodujeron las evaluaciones morfológicas, mientras que el metabarcoding bulk tendió a sobreestimar el estado ecológico. El metabarcoding de diatomeas recuperó gradientes coherentes de nutrientes y enriquecimiento orgánico, y las comunidades bacterianas revelaron señales sanitarias espacialmente estructuradas. Además, el enfoque multimarcador permitió detectar taxones invasores con alta sensibilidad e identificar un hotspot persistente de invasión en PI-PF. En conjunto, el marco integrado sitúa PI-PF en una condición ecológica intermedia-degradada respecto a los sistemas de referencia e impactado, y proporciona un estado base prerrestauración sólido para el seguimiento de trayectorias ecológicas durante la restauración urbana.

Effects of longitudinal fragmentation and environmental filtering on community assembly of benthic diatoms, fungi, and invertebrates

Jon Garrastatxu*, Maite Arroita, Ioar de Guzmán, Iñaki Fernández de Larrea, Arturo Elosegi, Aitor Larrañaga

Plant Biology and Ecology, Euskal Herriko Unibertsitatea EHU, 48940, Leioa, Spain

jon.garrastatxu@ehu.eus

Understanding how environmental filtering and spatial connectivity jointly shape riverine communities remains a central challenge in freshwater ecology. In dendritic river networks, dispersal is constrained by hierarchical branching structure and unidirectional flow, while anthropogenic barriers further disrupt longitudinal connectivity. Although environmental gradients are often assumed to dominate community assembly at broad spatial scales, fragmentation may impose strong, taxon-specific constraints on dispersal and recolonization, particularly in headwater systems. We evaluated the relative importance of environmental filtering, riverine distance, and longitudinal fragmentation in structuring benthic diatom, fungal, and invertebrate communities across five headwater catchments in the northern Iberian Peninsula. Environmental predictors were quantified at nested spatial scales (catchment, habitat, and local water quality), and spatial connectivity was represented by riverine distance along the network and cumulative obstacle height between sampling sites. Community composition was assessed using DNA metabarcoding, and pairwise community dissimilarities were analysed using Maximum Likelihood Population Effects models to account for non-independence among site pairs. Catchment- and habitat-scale environmental distances consistently explained the largest proportion of variance in community dissimilarity across taxa, supporting a dominant role of environmental filtering at broad and intermediate spatial scales. Habitat variables were particularly influential for diatoms. Local water quality showed comparatively weak and model-dependent effects. Spatial processes exhibited marked taxon-specific patterns. Riverine distance explained a moderate fraction of variation in fungal communities, consistent with flow- mediated dispersal along the network. In contrast, longitudinal fragmentation was a key predictor of invertebrate community dissimilarity and also contributed to diatom structure, albeit with smaller effect sizes. Overall, our results demonstrate that large-scale environmental context sets the primary template for community assembly, while connectivity and fragmentation exert taxon-specific constraints. Integrating landscape management with restoration of longitudinal connectivity is therefore important for conserving biodiversity in fragmented river networks.

"Genus 1" mystery unveiled: exceptional cryptic diversity and "polyphyly" within neotropical *Cricotopus* (diptera: chironomidae)

Diana Carolina Hoyos Jaramillo[1,2]*, Fabio Laurindo da Silva[3,4], Núria Bonada[1,5], Narcís Prat[1]

[1]FEHM-Lab (Freshwater Ecology, Hydrology and Management), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Catalonia/Spain. [2]Fundación FUNMAJO, EBA, RAIEC, Biodiversity Branch, Cucaita, Boyacá,Colombia. [3]Embrapa Meio-Norte, Avenida Duque de Caxias, 5650 C.P 001, Teresina, PI, 64008-780 Brazil. [4]Department of Zoology, Institute of Biosciences, University of São Paulo, Rua do Matão, Trav. 14, n.101, São Paulo, SP, 05508-090, Brazil. [5]Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Catalonia/Spain.

dicahoyosja@ub.edu

Neotropical high-altitude streams harbor a rich, yet poorly understood, chironomid fauna. Among these taxa, the informal "Genus 1" (sensu Roback & Coffman, 1983) has long attracted taxonomic interest. This study provided a comprehensive molecular re-evaluation of this group, revealing an extraordinary radiation of cryptic species within the genus *Cricotopus*. By integrating 259 new sequences of putative "Genus 1" specimens with global reference datasets of Rheocricotopus, Orthocladius, and Cricotopus, we applied ASAP, ABGD, bPTP, and Maximum Likelihood (ML) analysis to delimit evolutionary units and clarify their taxonomic placement. Phylogenetic analyses confirmed that all "Genus 1" specimens belonged exclusively to *Cricotopus*. Our results uncovered a remarkable diversity comprising 14 highly divergent molecular operational taxonomic units (MOTUs) – nine within the sp. 2 complex, two within the sp. 4 complex, and three within the "No Pupae" morphotype complex – previously masked under a single morphological concept. These complexes were designated in accordance with the original description. ML analysis confirmed that these lineages were polyphyletic, representing independent colonization events nested within the subgenera *Isocladius* and *Cricotopus s.* str. Distance-based methods (ASAP and ABGD) showed strong congruence and revealed a clear barcoding gap, with K2P distances reaching up to 20%. In contrast, the bPTP model was ineffective for this dataset, exhibiting low nodal support and a tendency to oversplit lineages. Despite pronounced molecular divergence, larval and pupal morphology exhibited marked stasis. Notably, four pupae matching the description of pupa sp2 corresponded to three different molecular units yet remained morphologically indistinguishable. This pattern indicated that traditional diagnostic characters were insufficient to capture the evolutionary complexity of the group. By clarifying the taxonomic placement and diversity of these lineages, this study resolved a four- decade-old taxonomic enigma and underscored the strength of integrative taxonomy in converting longstanding morphological uncertainty into a robust evolutionary framework for Neotropical biodiversity.

Redefining aquatic biomonitoring and biodiversity conservation through molecular insights

Nieves López-Rodríguez

Freshwater Ecology, Hydrology and Management (FEHM), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Spain.

nlopezro@ub.edu

Freshwater ecosystems deliver essential ecological functions but are increasingly affected by habitat fragmentation, altered flow regimes, and intensifying anthropogenic pressures. Effective assessment frameworks are therefore required to diagnose ecological condition, detect degradation trajectories, and inform management interventions. Iberian rivers, characterized by strong seasonality, frequent flow intermittency, and catchments exposed to cumulative human impacts, constitute highly dynamic systems in which ecological evaluation must be directly linked to conservation planning. Current monitoring and conservation practices rely predominantly on morphology-based taxonomic surveys that robustly characterize community composition. However, these approaches have limited power to detect rare or cryptic taxa and overlook intraspecific genetic variation, a key determinant of adaptive capacity and long-term population persistence. Excluding this dimension constrains the ability to anticipate biological responses to disturbance and to design conservation actions that reflect evolutionary processes. Molecular tools, particularly those based on environmental DNA, provide enhanced analytical resolution by enabling the detection of elusive organisms, the characterization of fine-scale genetic variability, and the non-invasive identification of taxa of conservation concern, including protected species and early-stage biological invasions. By incorporating genetic information alongside species-level data, these approaches improve the delineation of management units, refine assessments of demographic vulnerability, and strengthen the prioritization of restoration efforts. Here, we evaluate the incorporation of molecular methodologies into biomonitoring and conservation programs in Iberian rivers. Drawing on evidence from multiple research projects, we highlight that integrating molecular data increases detection sensitivity and ecological resolution while expanding the management relevance of conventional assessments. This combined framework enhances early-warning capacity, supports more precise conservation prioritization, and provides a stronger empirical basis for decision-making under ongoing global change, contributing to a more comprehensive and forward-looking strategy for freshwater ecosystem stewardship.

Evaluating DNA metabarcoding for river biomonitoring: in silico primer screening and comparative IBMWP assessment across river typologies

Alba M. Losa[1], Dominik Buchner[2], Alejandra Goldenberg-Vilar[2], Maria Morán-Luís[1], Mario Álvarez-Cabria[1], Jose Barquín[1], Florian Leese[2]

[1]IHCantabria - Instituto de Hidráulica Ambiental de la Universidad de Cantabria, C/ Isabel Torres, 15 39011, Santander, Spain [2]University of Duisburg-Essen, Department of Aquatic Ecology, Universitätsstraße 5 45141 Essen, Germany

albamaria.losa@unican.es

Macroinvertebrates are widely recognised as key ecological indicators in river ecosystems and constitute one of the most commonly used biological groups for assessing ecological status under the EU Water Framework Directive (WFD, Directive 2000/60/EC). Traditional ecological assessments, based on benthic macroinvertebrates, rely on morphological identification, but DNA metabarcoding is increasingly being considered for bioassessment under the WFD due to its reduced cost, rapid processing and consistently high taxonomic resolution. Moreover, DNA- based approaches overcome key limitations of morphological identification, which often requires specialised taxonomic expertise that is becoming progressively more difficult to secure. In Europe, the integration of DNA-based methods into routine biomonitoring depends largely on their compatibility with existing ecological indices developed from morphology-based assessments. Consequently, national programmes have adapted metabarcoding workflows to ensure that the same ecological metrics can be derived from molecular data. In this context, assessing the transferability of traditional indices to DNA-based outputs is essential. In the present study, we conducted an in silico evaluation of five widely used COI primer sets for freshwater macroinvertebrates, focusing on their ability to recover IBMWP-relevant families. Although the cytochrome c oxidase I (COI) gene is the most widely used barcode for freshwater macroinvertebrate biomonitoring, primer bias remains a major limitation. This is especially relevant for the IBMWP index, which incorporates taxa beyond the well-studied EPT groups, including families from Mollusca or Turbellaria that are often underrepresented or completely missed in COI-based metabarcoding. Secondly, we applied the best-performing primer to a field dataset to compare traditional and DNA-based bulk-sample approaches. Our analysis evaluated the transferability of the IBMWP index from traditional sampling to DNA metabarcoding across two Spanish river basins encompassing different river typologies. This combined in silico and empirical evaluation provides new insights into the feasibility of integrating DNA metabarcoding into routine freshwater biomonitoring under the WFD framework.

Uncovering diatom diversity and biogeography in Canary Islands barrancos through metabarcoding

Paula Mendoza[1,2], Xavier Benito[1], Rosa Trobajo[1]

[1]IRTA Marine and Continental Waters Programme, La Ràpita, Catalonia, Spain [2]Departament de Geografia, Universitat Rovira i Virgili, C/ Joanot Martorell 15, E43500 Vila-seca, Tarragona, Spain

paula.mendoza@irta.cat

In this study, we explore the molecular diversity and biogeography of benthic diatom communities of the barrancos on three islands – La Palma, La Gomera and Tenerife – using rbcL metabarcoding. On volcanic islands like these, running waters are usually scarce, spatially fragmented, and hydrologically variable, making them particularly vulnerable and ecologically unique. Our results reveal clearly differentiated assemblages, each island harbouring unique sequence variants and putative endemic taxa, most of which do not appear to have a morphological signature (at least not in LM). We took advantage of the increasing number of available rbcL metabarcoding datasets, from a wide geographical range, to compare Canaries freshwater diatoms with those occurring elsewhere. Several haplotypes were restricted to single barrancos in the Canaries, indicating strong spatial structuring at small geographic scales while others showed broad distributions. This brings diatoms in line with what has been known for many years in relation to higher plants and terrestrial vertebrates, which is that many islands (among them the Canaries) are recognised as global hotspots, largely due to their high levels of endemism and diversity. Unfortunately, the most diverse groups such as aquatic microorganisms, fungi and invertebrates tend to be much less studied due to the difficulties of sampling and of morphological identification. With the present study we show how metabarcoding offers solutions to these problems and at the same time demonstrate the ecological and biogeographical interest of the Canaries' barrancos diatom communities.

A2MOS: anthropic activity molecular signal in freshwater ecosystems

María Morán-Luis*, Alejandra Goldenberg-Villar, Alba M. Losa, Mario Alvarez- Cabria, Francisco J. Peñas, Alexia M. González-Ferreras, Ignacio Pérez-Silos, José Barquin

IHCantabria - Instituto de Hidráulica Ambiental de la Universidad de Cantabria, Post C/ Isabel Torres, 15 39011, Santander, Spain

moranluismc@unican.es

Human activities associated with urban and peri-urban areas and livestock activities are major drivers of change in freshwater ecosystems. These include wastewater discharges and recreational activities, as well as diffuse inputs from livestock production such as manure deposition and nutrient runoff. These activities leave detectable molecular signals in freshwater environments, making environmental DNA (eDNA) a powerful tool to detect them. The aim of this study is to test whether the level of human and livestock DNA in freshwater water (Anthropic Activity Molecular Signal, A2MOS, hereafter) can serve as a proxy for human activity and an indicator of anthropogenic pressure gradients. This molecular signal is expected to be modulated by hydrological processes and negatively associated with the integrity and biodiversity of freshwater ecosystems. To test this, we used a network of 25 sites across catchments in the Cantabrian Mountains (northern Spain), covering freshwater ecosystems including mountain lakes, headwater streams, intermediate river reaches, and main river channels. For each ecosystem, both control and impacted sites were included, allowing comparisons along an anthropogenic pressure gradient. This design enables the assessment of both point-source discharges (e.g., wastewater effluents) and diffuse inputs (e.g., agricultural runoff). At each site, eDNA metabarcoding was used to detect vertebrate biodiversity as well as human and livestock eDNA. Preliminary results indicate clear spatial variation in A2MOS values across ecosystems and along the anthropogenic pressure gradient. Across ecosystems, unimpacted sites showed very low A2MOS values, reflecting minimal human influence. Main river sections displayed intermediate values, likely influenced by dilution associated with higher discharge. Sites affected by diffuse pressures exhibited moderately high values, consistent with cumulative contributions from multiple small sources, whereas sites affected by direct discharges showed the highest A2MOS values. These patterns reveal increasing A2MOS values along anthropogenic pressure gradients and highlight the potential of human and livestock eDNA as indicators of anthropogenic pressure for freshwater monitoring and management.

¿Estamos preparados para el DNA-monitoring? Lagunas moleculares en la evaluación de macrófitos en España

Marta Pedron*, Antonio Picazo, Daniel Morant, Carlos Rochera, Antonio Camacho

Institut Cavanilles de Biodiversitat i Biologia Evolutiva, Universitat de València, C. Catedrático José Beltrán Martínez, nº 2, 46980, Paterna, Spain

marta.pedron@uv.es

El monitoreo basado en ADN (eDNA/Metabarcoding) promete transformar la evaluación del estado de ecosistemas acuáticos ante la actual escasez de taxónomos expertos. No obstante, su éxito está condicionado por las carencias en las librerías de referencia. Este estudio evalúa la representatividad molecular de los macrófitos en sistemas leníticos españoles (incluyendo carófitos, briófitos, hidrófitos vasculares y helófitos) bajo el marco de la Directiva Marco del Agua (DMA) y la Directiva Hábitats (DH). Concretamente, se analizó el estado de secuenciación de más de 500 taxones frente a marcadores clave (18S rRNA, rbcL, matK, ITS). Los resultados analizados indican que, si bien una amplia mayoría de las especies cuenta con al menos un marcador, persisten carencias moleculares en taxones diagnósticos críticos. Mediante simulaciones de 'peor escenario', se ha demostrado que estas ausencias pueden derivar en infravaloraciones del estado ecológico (DMA) y de conservación (DH) en diversos tipos de lagos de la DMA y en hábitats prioritarios como las charcas temporales mediterráneas (HIC 3170*). Se ha identificado un grupo de taxones de alta prioridad (especialmente de los géneros *Chara* y *Juncus*) cuya falta de información genética con relevancia taxonómica compromete la robustez legal de los futuros índices moleculares. Este trabajo subraya la necesidad de un enfoque multi-locus y proporciona una hoja de ruta estratégica para completar las bases de datos, garantizando que la transición al biomonitoreo molecular de los macrófitos acuáticos en España sea científicamente defendible y administrativamente fiable. El trabajo ha sido financiado por el proyecto Horizon Europe eDNAqua-Plan Grant No. 101112800.

Tracking the microbial impact of flood event in L'Albufera de Valencia: pathogens, resistance genes and pollutant degradation potential

Antonio Picazo[1]*, Andreu Rico[1], Carlos Rochera[1], Daniel Morant[1], Maria Sahuquillo[2], Ignacio Lacomba[2], Antonio Camacho[1]

[1]Institut Cavanilles de Biodiversitat i Biologia Evolutiva, Universitat de València, C/Catedrático José Beltrán Martínez, nº 2, 46980, Paterna, Spain. [2]Conselleria de Medi Ambient, Infraestructures, Territori i de la Recuperació, Generalitat Valenciana, 46071 Valencia, Spain

antonio.picazo-mozo@uv.es

Flood events are becoming more frequent and more severe, with the Mediterranean basin identified as one of the most vulnerable regions to this intensification. In October 2024, an extreme precipitation episode affected the Valencia region (Spain), generating a catastrophic flash flood. Much of the floodwater, together with associated sediments and debris, was transported into L'Albufera Natural Park. The aim of this study was to assess its impact on microbiological contamination, the resistome, and the microbial potential for contaminant degradation, as well as their temporal dynamics over the course of one year of monitoring. Physical and chemical variables were monitored as well, and an integrated molecular analysis of water and sediment was carried out using 16S metabarcoding and shotgun metagenomics. Metabarcoding was used to characterize the overall microbial community structure and the potentially pathogenic bacterial species. Metagenomes were analyzed against the CARD-RGI and MEGARes databases to describe the resistome, and key genes involved in the degradation of the main contaminants detected in the system were evaluated. The results showed a very strong impact in November 2024, just 15 days after the flood, with peak levels of pathogens and resistance genes particularly in irrigation channels, especially "Barranco del Poyo". In water, the irrigation channels concentrated the highest absolute pulses of microbiological contamination, whereas the lake acted as an integrating compartment, homogenizing the signal and maintaining a relative persistence of genera such as *Legionella* and, in summer, *Vibrio*, the later with lower absolute loads. In sediment, the signal was initially stronger and more persistent, behaving as a temporary reservoir. The resistome followed a similar trajectory, CARD-RGI revealed a very pronounced initial pulse in November, followed by a progressive contraction, whereas MEGARes showed a more stable and complex persistence in water — including resistance to antibiotics, metals, and biocides — and a clearer attenuation in sediment. Degradation of genes of selected contaminants, responded in a selective and transient manner, with specific responses observed for some persistent compounds. Overall, the system showed a clear temporal dilution of the impact, but also a residual footprint that remained detectable months after the event.

Molecular and traditional approaches for biomonitoring disconnected pools in temporary rivers using diatoms

Guillermo Quevedo-Ortiz[1,2]*, Nieves López-Rodríguez[1], Rosa Trobajo[3], Joan Gomà[1], Núria Bonada[1,2]

[1]FEHM-Lab (Freshwater Ecology, Hydrology and Management), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia. Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Catalonia, Spain. [2] Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Catalonia, Spain. [3]IRTA, Marine and Continental Waters Programme, Ctra de Poble Nou Km 5.5, E43540, La Ràpita, Catalonia, Spain

gquevedoor@ub.edu

Temporary rivers alternate between flowing and dry phases. Although they represent the most common river type in the Mediterranean Basin, significant gaps remain in their bioassessment under the Water Framework Directive (WFD). This issue becomes even more evident when temporary rivers fragment into a series of disconnected pools during the dry period, as standardized bioassessment methods perform poorly in such habitats; therefore new approaches and metrics should be developed. Diatoms are a key biological element in bioassessment under the WFD, although species-level identification is often challenging. Traditional morphological methods may underestimate species richness, whereas molecular approaches are limited by the incomplete representation of taxa in genetic reference databases. To improve the bioassessment of Mediterranean temporary rivers, using diatoms, we compared morphological and molecular approaches using biofilm and sediment samples from 58 disconnected pools in Catalonia (Spain). Both substrates were analyzed using rbcL metabarcoding, and biofilm samples were additionally identified through light microscopy. Our results indicate that sediment and biofilm provide complementary information on the composition of diatom communities in these habitats. We expect that integrating both approaches will allow the identification of key species that reflect the ecological characteristics and dynamics of temporary rivers, with particular attention to disconnected pools, which are often overlooked. These contributions may help improve and refine future bioassessment metrics, which are increasingly needed given the growing number of temporary rivers as a consequence of global change.

Assessment of fish diversity in Segura River reservoirs using environmental DNA: new perspectives for monitoring

Juan Antonio Villaescusa[1], Luis Torrijos[1], Raúl Gracia[1], Miriam Blanco[1], Beatriz Vallejo[1], Ana Pujante[1], Maria Jose Villena[1], Silvia Rojas[2], Sonia Hernández[2]

[1]Laboratorios Tecnológicos de Levante S.L., 46980, Paterna, Spain. [2] Confederación Hidrográfica del Segura, 30004 Murcia

juanantonio.villaescusa@ltlevante.com

The study of environmental DNA (eDNA) has become a powerful tool for monitoring aquatic communities. Its ability to detect species in a non-invasive manner enhances monitoring programs and complements traditional survey methods. In this study, fish communities were evaluated in 17 reservoirs within the Segura River basin using high-throughput sequencing techniques, with the aim of characterizing their diversity and analyzing distribution patterns. The results show that eDNA can identify clear differences among reservoirs, ranging from systems dominated by a few species—such as Santomera—to others with high richness, such as La Pedrera, where eleven different taxa were detected. However, it is important to interpret relative abundance data with caution, as they reflect DNA concentration rather than actual biomass, and may be influenced by PCR-related biases. The study also highlights the importance of sampling both shoreline and water column, including multiple replicates, which significantly increases species detection. Among the most prevalent taxa were *Cyprinus carpio* and *Luciobarbus sclateri*, present in 16 reservoirs, along with several less abundant taxa. Additionally, the absence of *Silurus glanis*, a high-risk invasive species, underscores the value of eDNA as an early detection tool for invasive species and as support for ecological management within the Segura basin. Nevertheless, for some genera such as *Luciobarbus*, species-level identification remains challenging due to low genetic divergence and frequent hybridization, which limit taxonomic resolution and hinder reliable species assignments. In conclusion, this study demonstrates that eDNA analysis is a robust tool for assessing fish communities, optimizing ecological monitoring, and improving the management of aquatic ecosystems

Are modern reference lakes truly natural? Insights from palaeolimnological records in the Azores (Macaronesia)

Pedro M. Raposeiro[1,2]*, Miguel Matias[3], Martin Souto[1,2], Armand Hernández[4], Roberto Bao[4] , Alberto Sáez[5], Santiago Giralt[6], Vítor Gonçalves[1,2]

[1]University of the Azores, Faculty of Sciences and Technology, Rua da Mãe de Deus, 9500 321 Ponta Delgada [2]CIBIO, Research Centre in Biodiversity and Genetic Resources, InBio Associate Laboratory, BIOPOLIS Program in Genomics, Biodiversity and Land Planning; UNESCO Chair – Land Within Sea: Biodiversity & Sustainability in Atlantic Islands, University of the Azores, Rua da Mãe de Deus, 9500 321 Ponta Delgada, Portugal. [3]Departamento de Biogeografía y Cambio Global, Museo Nacional de Ciencias Naturales, CSIC, Madrid, Spain. [4]GRICA-BIOpast Group, Centro Interdisciplinar de Química e Bioloxía (CICA), Faculty of Sciences, Universidade de Coruña, Coruña, Spain. [5]UB-Geomodels Research Institute. Department of Earth and Ocean Dynamics, Universitat de Barcelona, Martí i Franquès s/n, 08028 Barcelona, Spain 6Geosciences Barcelona (GEO3BCN), CSIC, Barcelona, Spain.

pedro.mv.raposeiro@uac.pt

Freshwater ecosystems across Macaronesia are increasingly threatened by land-use change, nutrient enrichment, invasive species and climate pressures, yet effective conservation and biomonitoring require robust definitions of ecological reference conditions. In many island systems, however, the “naturalness” of present-day reference sites remains uncertain because pre- disturbance baselines are poorly known. Remote oceanic islands with well-constrained settlement histories provide an opportunity to directly reconstruct these baselines and evaluate long-term ecosystem change relevant to water management and biodiversity conservation. We investigated volcanic lake systems from the Azores (North Atlantic), a Macaronesian archipelago, where major landscape transformation followed settlement. Radiometrically dated sediment cores were analysed for subfossil diatom and chironomid assemblages to reconstruct past limnological conditions and ecological trajectories. Pre-settlement communities indicate stable oligo-mesotrophic conditions and distinct biological assemblages compared with those observed today. Following human colonisation, lakes experienced rapid ecological reorganization, including increased nutrient loading, altered community structure and a persistent shift away from historical baselines. Our findings show that contemporary “reference” lakes may already represent post-impact states, potentially leading to underestimation of ecological degradation in regional assessments. This highlights the critical role of palaeolimnology in defining realistic conservation targets, improving biomonitoring frameworks and guiding restoration strategies for Macaronesian freshwaters. By providing long-term perspectives on ecosystem resilience and thresholds of change, island sediment records offer essential evidence to support sustainable water-resource management and biodiversity protection across the region. P.M.R. was supported by Fundação para a Ciência e a Tecnologia (FCT) (DL57/2016/ICETA/EEC2018/25) and the DISCOVERAZORES research project (PTDC/CTA-AMB/28511/2017), as well as by the European Union, QREN, FEDER, and COMPETE, which funded CIBIO/InBIO (projects UIDB/50027/2020, UIDP/50027/2020 and LA/P/0048/2020).

DNA Barcoding reveals hidden diversity of aquatic macroinvertebrates in the streams of the Canary Islands

Raúl Acosta[1]*, Miguel Cañedo-Argüelles[1], Núria Cid[2], Jose María Fernández-Calero[1,3], Pau Fortuño[5], Jérôme Latron[1], Pau Saa[2], Rosa Trobajo[2], Xavier Benito[2], Carlos Alcaraz[2], Paula Mendoza[2], David Mann[2], Marcos González[6], Francesc Gallart[1], Pilar Llorens[1], Miriam Salguero[1], Julie Crabot[1], Ian Criado[3], Brent Emerson[7], Nieves López-Rodríguez[1,3], Núria Bonada[3,4], Virgilio Hermoso[8], Maria Soria[9], Belinda Gallardo[10], Paula Arribas[7]

[1]SHE2, Institut de Diagnòstic Ambiental i Estudis de l'Aigua (IDAEA- CSIC) 08034, Barcelona, Spain. Freshwater Ecology, Hydrology and Management (FEHM). [2]Institut de Recerca i Tecnologia Agroalimentàries (IRTA). Crta. Poble Nou, Km 5,5 43540 La Ràpita, Spain. Freshwater Ecology, Hydrology and Management (FEHM) [3]Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals. Universitat de Barcelona (UB). 08028 Barcelona, Spain. Freshwater Ecology, Hydrology and Management (FEHM). [4]Institut de Recerca de la Biodiversitat (IRBio). Universitat de Barcelona (UB). 08028, Barcelona, Spain. [5]Centre de Recerca Ecològica i Aplicacions Forestals (CREAF). Campus Bellaterra. Universitat Autònoma de Barcelona. Edifici C, 08193, Cerdanyola del Vallès, Spain. [6]Departamento de Zoología, Genética y Antropologia Física. Universidad de Santiago de Compostela, Spain. [7]Instituto de Productos Naturales y Agrobiología (IPNA) – CSIC. Avda. Astrofísico Francisco Sánchez, 38206 - San Cristóbal de La Laguna, Santa Cruz de Tenerife, Spain. [8]Departamento de Biología Vegetal y Ecología. Universidad de Sevilla, Avda. Reina Mercedes, s/n, 41011, Sevilla, Spain. [9]BETA Technological Centre. Universitat de Vic-Universitat Central de Catalunya (UVic- UCC). Crta. de Roda, 70, 08500, Vic, Barcelona. [10]Instituto Pirenaico de Ecología (IPE) – CSIC, Av. Montañana, 1005, Zaragoza 50059, Spain

carhse@cid.csic.es

The Canary Islands constitute a biodiversity hotspot characterised by exceptionally high levels of endemism driven by a unique combination of geological, geographical, and climatological factors that promote speciation. However, our knowledge of aquatic macroinvertebrate biodiversity remains fragmented. The lack of information is even more pronounced regarding their molecular diversity. Only 58% of the recorded species in the Biodiversity Data Bank of the Canary Islands (BIOTA) have molecular sequences (DNA barcodes) available in online repositories, most of these correspond to widely distributed taxa. In contrast, only 24 of the 114 Canarian endemic species (21%) have an associated barcode. Within the framework of the BIOACUANA and CONACAN projects, 1953 specimens were selected for DNA extraction and barcoding (658 bp fragment of the cox1 gene). These individuals, collected between November 2022 and 2023 from streams on Tenerife, La Palma, and La Gomera, represented 320 morphologically identified species or morphospecies. Barcode sequences were successfully obtained for 1653 specimens, yielding (success rate exceeding 84%). A preliminary approach to molecular species delimitation, using a 3% genetic divergence threshold to define lineages, revealed 790 molecular entities— more than double the number estimated from morphology. This discrepancy can be explained by a recurrent pattern: multiple cases in which a single morphologically defined species corresponds to several distinct molecular entities, suggesting the presence of cryptic lineages within the Canarian macroinvertebrate fauna. Moreover, many of these molecular entities were linked to specimens collected from different islands, potentially indicating the existence of previously undetected island-endemic lineages. This barcode database of aquatic macroinvertebrates constitutes a key resource and an advance in estimating genetic and phylogenetic

diversity in community ecology analyses and species vulnerability assessments. Finally, it is important to highlight that the generated molecular database is an essential resource for future biomonitoring of macroinvertebrate fauna in the Canary Islands using molecular tools.

Springs on the island of La Palma: multifunctionality, meanings, and protection strategies

José Antonio Batista-Medina[1]*, Alejandro Rodríguez-Pais[2]

[1]Instituto Universitario de Investigación Social y Turismo (ISTUR), Universidad de La Laguna, C/Padre Herrera, s/n, San Cristóbal de La Laguna (Tenerife), España. [2]Instituto Universitario de Investigación Social y Turismo (ISTUR), Universidad de La Laguna, C/Padre Herrera, s/n, San Cristóbal de La Laguna (Tenerife), España

jbatisme@ull.edu.es

The proposed paper analyses the springs on the island of La Palma (Canary Islands, Spain) and their current situation, although the analytical perspective will be diachronic as we consider that the present and, to a large extent, the future are the result of processes of long historical development (in our case study, since the early 16th century). In this regard, our approach is based on the idea that socioenvironmental realities (an aquifer, a protected natural area, a river, etc.) are historical, the consequences of complex and changing dynamics that shape their uses, functions, meanings, and values over time. Based on this analytical approach, we will focus on the various uses and functions of the island's springs (productive, environmental, socio-cultural, tourist, etc.) and their (changing) meanings and values as we argue that both dimensions (the material and the symbolic) help to understand and explain the positions taken in relation to their protection over the last two centuries.

Characterizing flow regimes in streams relevant for freshwater biodiversity conservation in the Canary Islands

Núria Cid[1]*, Raúl Acosta[2], Jose María Fernández-Calero[2,3], Pau Fortuño[5], Jérôme Latron[2], Rosa Trobajo[1], Xavier Benito[1], Carles Alcaraz[1], Paula Mendoza[1], David Mann[1], Marcos González[6], Francesc Gallart[1], Pilar Llorens[1], Miriam Salguero[1], Julie Crabot[1], Ian Criado[3], Brent Emerson[7], Nieves López-Rodríguez[2,3], Núria Bonada[3,4], Virgilio Hermoso[8], Maria Soria[9], Belinda Gallardo[10], Paula Arribas[7], Miguel Cañedo-Argüelles[2]

[1]IRTA Marine and Continental Waters Programme. Crta. Poble Nou, Km 5,5 43540 La Ràpita, Spain. [2]SHE2, Institut de Diagnòstic Ambiental i Estudis de l'Aigua (IDAEA- CSIC) 08034, Barcelona, Spain. Freshwater Ecology, Hydrology and Management (FEHM). [3]Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals. Universitat de Barcelona (UB). 08028 Barcelona, Spain. Freshwater Ecology, Hydrology and Management (FEHM). [4]Institut de Recerca de la Biodiversitat (IRBio). Universitat de Barcelona (UB). 08028, Barcelona, Spain. [5]Centre de Recerca Ecològica i Aplicacions Forestals (CREAF). Campus Bellaterra. Universitat Autònoma de Barcelona. Edifici C, 08193, Cerdanyola del Vallès, Spain. [6]Departamento de Zoología, Genética y Antropologia Física. Universidad de Santiago de Compostela, Spain. [7]Instituto de Productos Naturales y Agrobiología (IPNA) – CSIC. Avda. Astrofísico Francisco Sánchez, 38206 - San Cristóbal de La Laguna, Santa Cruz de Tenerife, Spain. [8]Departamento de Biología Vegetal y Ecología. Universidad de Sevilla, Avda. Reina Mercedes, s/n, 41011, Sevilla, Spain. [9]BETA Technological Centre. Universitat de Vic-Universitat Central de Catalunya (UVic- UCC). Crta. de Roda, 70, 08500, Vic, Barcelona. [10]Instituto Pirenaico de Ecología (IPE) – CSIC, Av. Montañana, 1005, Zaragoza 50059, Spain

nuria.cid@irta.cat

The streams of the Canary Islands are highly vulnerable habitats that harbour endemic and endangered aquatic species. However, they remain poorly studied and are not recognized by environmental and biodiversity policies. In this context, CONACAN and BIOACUANA projects inform the protection of freshwater biodiversity of the Macaronesian Region by obtaining hydrological and biological data from streams in Tenerife, la Palma and la Gomera. Since most of these streams are ungauged and have intermittent flow, the characterization of the hydrological regime needs to be evaluated by alternative methods. Here we obtained information of the three aquatic phases (flow, disconnected pools and dry riverbed) from different years and seasons in 47 streams, using (1) water conductivity HOBO sensors, (2) observations from field visits, (3) aerial photographs, and (4) georeferenced photos from hiking routes. In parallel, we conducted interviews to the local people and stakeholders. This data served as input for the Temporary Rivers' Ecological and Hydrological Status (TREHS) software, which by combining this information gave metrics on the permanence of water flow (Mf), the presence of disconnected (Md) and complete drying (Md), their temporal patterns, and the classification of the flow regime. Based these metrics, 34% of the streams were perennial and 70% of them showed permanence of surface water as either flow or disconnected pools phases during >90% of time. Only 13% of the sites were most of the time in the dry phase. Overall, interviews corroborated the results, only showing a few discrepancies. These results showed the capacity of the streams to serve as habitats for the development of aquatic life. We also demonstrated the value of the disconnected pools when aquatic biodiversity is the focus, shedding light on their potential as key habitats for the conservation of aquatic biodiversity in the Canary Islands.

Hidden microbial biodiversity at risk: newly discovered cyanobacteria from the Azores and their implications for freshwater conservation

Vítor Gonçalves[1,2]*, Rita Cordeiro[1], Amélia Fonseca[1,2], Rúben Luz[1]

[1]CIBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos, InBIO Laboratório Associado, BIOPOLIS Program in Genomics, Biodiversity and Land Planning, UNESCO Chair—Land Within Sea: Biodiversity & Sustainability in Atlantic Islands, Universidade dos Açores, 9500-321 Ponta Delgada, Portugal. [2]Faculdade de Ciências e Tecnologia da Universidade dos Açores, 9500-321 Ponta Delgada, Portugal

vitor.mc.goncalves@uac.pt

Freshwater ecosystems of Macaronesia harbour an exceptional yet critically under-documented cyanobacterial diversity. Recent polyphasic surveys across Azorean lakes, streams, springs, wetlands, and aerophytic habitats have uncovered a remarkable number of novel lineages, revealing the Azores as a hotspot of microbial endemism and hidden biodiversity. Newly described taxa include multiple freshwater filamentous and coccoid genera (e.g., Tumidithrix, *Radiculonema*, *Leptodesmis*, *Pycnacronema*, *Pseudocalidococcus*), as well as several terrestrial or semi-aquatic species (*Venetifunis*, *Albertania*, *Kovacikia*, *Pegethrix*). More recently, the genus *Azorothrix*, including *A. ramosa*, was described from multiple lakes and streams, further emphasising the unique evolutionary trajectories of cyanobacteria in isolated Atlantic islands. This expanding taxonomic framework has direct implications for conservation. Many of these taxa inhabit highly vulnerable environments, such as oligotrophic crater lakes, headwater streams, volcanic caves, and aerophytic refugia. These habitats are highly vulnerable to hydrological change, nutrient enrichment, invasive species, physical disturbance, and climate-driven ecosystem shifts. Given the central role of cyanobacteria in primary productivity, nutrient cycling and biofilm structure, the loss of undescribed or endemic taxa could have disproportionate ecosystem-level consequences. Metabolomic profiling reveals that several newly discovered species produce unique, previously unknown bioactive secondary metabolites, reinforcing both their ecological significance and their value as endogenous genetic resources. Together, these findings highlight an urgent need to integrate microbial diversity into freshwater conservation strategies, biomonitoring programmes, restoration initiatives and environmental policy frameworks across the Macaronesia. Protecting these ecosystems is essential to avoid irreversible losses of evolutionarily distinct lineages and to maintain the ecological functions they underpin under accelerating global change.

Madeira freshwater system: nutrient and potential toxic elements loads from the ribeiras to coastal zones. A land–ocean continuum perspective.

Aracelis Narayan[1,2]*, Carlos Lucas[1], Caroline Ferreira[1,3], Omar Sánchez[4,5], Thais Coppen[6,7,8], Jesus Reis[1], Rui Caldeira[1,3]

[1]Madeira Oceanic Observatory, ARDITI, Funchal, Portugal. [2]Earth Science Institute, Faculty of Science, University of Porto, Porto, Portugal. [3]Dom Luiz Institute, Faculty of Science, University of Lisbon, Lisbon, Portugal. [4]Department of Organisms and Systems Biology (Zoology), University of Oviedo, Oviedo, Spain. [5]Environment and Sustainability Area, TAXUS Medio Ambiente, Oviedo, Spain. [6]Insect collection Madeira University, Funchal, Madeira, Portugal. [7]Center of Investigation in Biodiversity and Genetic Resources, University of Porto, Porto, Portugal. [8]Department of Biology, Faculty of Science, University of Porto, Porto, Portugal

aracelis.rajnauth@oom.arditi.pt

Madeira's Ribeiras are small, steep riverine systems that transport nutrients and pollutants in both dissolved and particulate phases, connecting inland catchments with the coastal zone. Fine sediments transported by these freshwater systems can adsorb potentially toxic elements (PTE), such as Pb, Zn, Cu, and Cd, derived principally from anthropogenic sources. The main objective of this study was to investigate nutrient dynamics in surface waters and the distribution of PTE in bed sediments from three Ribeiras affected by urban, agricultural, industrial, and tourism-related pressures, and to assess their spatial and temporal variability. The selected watercourses were Ribeira São João, Ribeira Santa Luzia, and Ribeira João Gomes, located in Funchal, the main site with high population pressure. Surface water samples were collected at three sites along each stream (upper, middle, and lower reaches). Samples were filtered in the field through 0.45 µm membranes and analysed for nitrate, nitrite, phosphate, and silicate using a segmented flow auto-analyser (QuAAtro, SEAL Analytical). PTE concentrations in sediments were determined by atomic absorption spectroscopy. Sampling campaigns were conducted during 2024–2025. Preliminary results indicate that nitrate and silicate fluxes from freshwater to the coastal zone are more significant than nitrite and phosphate inputs. Geochemical composition of bed sediments differs between inland and coastal areas, showing enrichment in trace elements (Cu, Zn, Cr, and Ni) and major elements (Fe, Al, and Mn). Patterns of elemental enrichment and depletion suggest contributions from industrial, agricultural, and urban effluents, reflecting processes of adsorption, transport, deposition, and dilution along the land–ocean continuum. From an integrated land–ocean perspective, freshwater and coastal systems function as a connected continuum in which terrestrial pressures directly influence marine ecosystem quality. Quantifying the variability, magnitude, and composition of nutrient and metal fluxes is therefore essential to support integrated catchment–coast management and sustainable water governance strategies.

Environmental Drivers of Aquatic Macroinvertebrate Community Structure in Permanent and Non-Permanent Streams of Tenerife

Felipe Rodríguez-Arvelo[1]*, Laura Ortega-Calcines[1], Natalia Sierra-Cornejo[2], Amanhuy Duque-Hernández[2], David Lugo[1], Elena Rocafull[2], Edoardo Asquini[3,4,5], Carlos Ruiz[1], Volker Lüderitz[6], Jose Ramón Arévalo[2]

[1]Department of Animal Biology, Soil Science, and Geology, University of La Laguna, San Cristóbal de La Laguna, Tenerife, Spain. [2]Department of Botany, Ecology and Plant Physiology, University of La Laguna, San Cristóbal de La Laguna, Tenerife, Spain. [3]Department of Earth and Sea Sciences, University of Palermo, Palermo, Italy. [4]NBFC, Palermo, Italy. [5]Department of Agricultural, Food, Environmental and Animal Sciences. University of Udine, Italy. [6]Fachbereich Wasser- und Kreislaufwirtschaft, Hochschule Magdeburg-Stendal, Magdeburg, Germany

frodriguezarvelo@gmail.com

Freshwater ecosystems cover a small fraction of the Earth's surface but support disproportionately high biodiversity, including many endemic and sensitive species. In the Canary Islands, volcanic origin and geographic isolation have produced highly endemic aquatic communities that are disharmonic and species-poor. The number of permanent streams is declining rapidly, with many drying completely or suffering seasonal droughts due to aquifer overexploitation, making these habitats extremely vulnerable to biodiversity loss. This study evaluates the biodiversity of aquatic macroinvertebrates in Tenerife and the ecological factors shaping their distribution. Surveys were conducted in ten permanent and non-permanent streams, with three sampling places per stream surveyed during two periods (March–May and September–November). A full inventory of macroinvertebrate species was compiled. Biotic variables, including riparian and aquatic vegetation, and abiotic factors, such as water temperature, pH, electrical conductivity, nutrient concentrations, water velocity, and substrate type, were recorded to assess their influence on species distributions. Preliminary results show that endemic species are mainly restricted to permanent streams, highlighting their vulnerability to habitat loss. Water availability and stream permanence appear to be key drivers of macroinvertebrate community structure across Tenerife. Aquifer depletion from groundwater overexploitation, which reduces or eliminates permanent streams, represents a serious threat to these endemic species. These findings emphasize the urgent need for conservation strategies and sustainable water management to preserve freshwater biodiversity in Tenerife and other island ecosystems, ensuring the long-term survival of sensitive aquatic communities.

Combining duckweed and biofilms to improve water quality treatment in small urban wastewater treatment plants

Lluís Bertrans-Tubau[1]*, Laura Dausà[1], Albert Codina[1], Carmen Renzi[1], Meritxell Abril[1], Lorenzo Proia[1], Julio C. López-Doval[1], Meritxell Uroz[1], Nicola Montemurro[2], Victoria Osorio[2]

[1]BETA Technological Centre (UVIC-UCC), Carretera de Roda 70, 08500 Vic, Barcelona, Spain. [2]Institute of Environmental Assessment and Water Research (IDAEA-CSIC), Carrer de Jordi Girona 18-26, 08034 Barcelona, Spain

lluis.bertrans@uvic.cat

Small urban wastewater treatment plants (UWWTPs) are facing complex challenges regarding the improvement of their treatments. The current revised Urban Wastewater Treatment Directive in the European Union (2024/3019) is still lacking stricter restrictions in small facilities (< 10,000 population equivalent). This research evaluated a bench-scale combined bioreactor integrating duckweed and biofilms to assess the potential capacity of this nature- based solution (NBS) for the removal of nutrients, faecal indicator bacteria, and contaminants of emerging concern (CECs). The treated effluent was reused as reclaimed water for hydroponic lettuce cultivation. The main objective was to improve effluent quality in small UWWTPs, thereby reducing the environmental impact of their discharges into receiving aquatic ecosystems. This laboratory-scale system represents a preliminary step toward future upscaling as a pilot tertiary treatment under real operational conditions. Preliminary results showed high removal efficiencies for nitrogen (56%), phosphorus (82%), and Escherichia coli (94%). When the treated effluent was further applied to hydroponic lettuce cultivation, removal efficiencies increased to 66% for nitrogen, 85% for phosphorus, and 97% for E. coli, indicating that crop production may provide an additional treatment step. Although lettuce growth was limited under the tested conditions, the system achieved substantial reductions in CEC occurrence, with 35% of detected compounds (n = 114) significantly reduced. Several CECs, including atenolol, metoprolol, propranolol, cocaine, climbazole, imazalil, acesulfame-K, and fipronil, showed considerable removal efficiencies exceeding 50%. Overall, this research was based on the potential of integrating duckweed and biofilm bioreactors and hydroponic systems as sustainable tertiary treatments for small UWWTPs. The results support the need to strengthen treatment strategies and policy frameworks to improve water quality and promote reclaimed water reuse in the context of environmental pressures and climate change scenarios.

Can NBS be used as tertiary treatments in WWTP's? An indoor multiproxy analysis to test environmental impacts of reclaimed water

Julio Cruz Vila*, Julio César López Doval, Lorenzo Proia

BETA Technological Center, University of Vic – Central University of Catalonia (BETA- UVIC-UCC), E-08500, Vic, Spain

julio.cruz@uvic.cat

Wastewater treatment plants (WWTPs) have greatly improved wastewater (WW) quality in recent decades, but they remain major contributors to the ecological and chemical deterioration of freshwater bodies in the Mediterranean region due to the seasonal low flows circulating in these rivers and the effects of Global Change. In this context, a proposal of Nature Based Solutions (NBS) is FRENAWASTE, a low-cost NBS designed as a tertiary treatment based on ecosystem attenuation. It combines the activity of lotic and lentic benthic (biofilm), planktonic (microalgae), and floating aquatic macrophytes to maximize pollutant removal from treated urban wastewaters through mechanisms such as nutrient uptake, biotransformation, biodegradation, and adsorption. To check the capacity of NBS Tertiary treatments to improve water quality of WWTP effluents, and therefore diminish impact in receiving freshwater ecosystems, we designed an experimental approach with three different treatments, where we have exposed biofilms and grazers (*Physa acuta*) in indoor mesocosms to; effluents from WWTP (WW) , the NBS effluent and dechlorinated tap water (used as Control). For a more realistic environmental assessment, dilution factor and trophic state of a model Mediterranean river was reproduced. The experiment lasted for 43 days and we measured biomass, chlorophyl content and community changes in biofilm. We also evaluated grazer survival and biomass gain in a 9-day exposure experiment in the same channels. Our test results showed that for primary producers there were differences in biomass among treatments, with higher biomass produced in biofilms affected by WW treatment, but in contrast, NBS effluents generated greater chlorophyl contents over time and also generated differences in the biofilm community at all the studied levels at a specific experimental time . On the other hand, a higher percentage of survivors and greater biomass gain for snails was observed for the NBS treatment compared to WW. These preliminary results suggest that further analysis is required to determine if NBS improve the quality of reclaimed WW.

BioBass: balsas de regulación y biofilm para una potabilización resiliente

Sònia Torras[1], Salvador Graus[1], Julio Cesar López[2], Lídia Martín[1], Lorenzo Proia[2], Anna Treserra[1], Guillem Treserra[1], Carmen Espinosa[1]*

[1]Aigües de Vic S.A., Carrer de la riera 6, baixos, 08500, Vic, Barcelona, Spain. [2]Centro Tecnológico BETA, Carrer de Sant Jordi, 65, 08500 Vic, Barcelona, Spain

cespinosa@aiguesvic.com

El suministro de agua potable afronta retos crecientes derivados de la variabilidad hidrológica, el cambio climático y la aparición de contaminantes emergentes. Estas presiones son especialmente críticas en sistemas que dependen exclusivamente de captaciones superficiales sin regulación previa. En la comarca de Osona (Cataluña), diversos municipios se abastecen directamente del río Ter, sin embalses que permitan amortiguar episodios extremos o picos de contaminación, lo que compromete la resiliencia hídrica regional. En este contexto, el proyecto BioBass evalúa de forma experimental el papel combinado de balsas de residencia hidráulica y comunidades microbianas bentónicas como Solución Basada en la Naturaleza orientada a reforzar la robustez del sistema de potabilización. El proyecto no se limita a plantear una función de almacenamiento, sino que analiza el comportamiento dinámico del agua durante distintos tiempos de residencia, cuantificando su efecto sobre parámetros fisicoquímicos, estabilidad del agua y respuesta frente a eventos extremos. Un eje central del proyecto es la determinación del tiempo de residencia hidráulica óptimo, integrando criterios de calidad, estabilidad y seguridad sanitaria. De forma complementaria, se estudia el desarrollo de biofilms sobre superficies de soporte específicas y su contribución potencial a procesos de transformación y atenuación de compuestos, evaluando su papel como mecanismo natural de mejora de calidad dentro de un sistema técnicamente controlado. La validación se desarrolla en una planta piloto ubicada en la ETAP gestionada por Aigües de Vic, con agua real del río Ter, lo que permite trabajar bajo condiciones de alta variabilidad climática e hidrológica. La comunicación presentará el diseño metodológico y los primeros resultados obtenidos.

LIFE BIODAPH2O: An Eco-efficient system for wastewater tertiary treatment and water reuses in the Mediterranean region

Julio C. López-Doval[1]*, Jordi Colomer[2], Manuela Hidalgo[3], Víctor Matamoros[4], Teresa Serra[2], Teresa de la Torre[5], Victòria Salvadó[3]

[1]Centre Tecnològic BETA – Universitat de Vic; Applied Ecology and Global Change Unit, E-08500, Vic, Spain. [2]Department of Physics, University of Girona (UdG), E-17003, Girona, Spain. [3]Department of Chemistry, University of Girona (UdG), E-17003, Girona, Spain. [4]Department of Environmental Chemistry, IDAEA-CSIC, E-08034, Barcelona, Spain. [5]Sorigué, S.A.U., E- 25006, Lleida, Spain

juliocesar.lopez@uvic.cat

LIFE BIODAPH2O is a demonstration project with the main objective of scaling-up and implementing an eco-efficient nature-based tertiary wastewater treatment (BIODAPH) at two demo sites located in two water-stressed regions of the Mediterranean area. This system will produce reclaimed water that will contribute to diminish discharges of pollutants to freshwater ecosystems and to promote agricultural reuse. The BIODAPH system, is based on the depuration capacity of freshwater communities, combining Daphnia sp. and biofilms for removing nutrients, organic carbon, suspended solids, pathogens, heavy metals, emerging and priority pollutants and micro plastics. The implementation of this system at an urban WWTP in Girona, Spain, will reduce the impact of secondary wastewater discharges to the Onyar River, while improving the chemical and ecological quality of aquatic ecosystems. In the case of Greece pilot in the Antissa WWTP (Lesvos), the system will provide reclaimed water for irrigation purposes. The systems have an operating volume of 200 and 20 m^3 respectively. The system has been monitored for 2 years to control its efficiency and maximize depuration capacity. Three different HRT were tested in both demo sites, considering seasonal variability. Removal capacities of 73% for TSS, 30% for COD, 46% for BOD, 27% for phosphate and 98% for *E. coli* were obtained whereas attenuation of emerging pollutants ranged from negligible to 80%. In addition, biological parameters related to biofilm development and *Daphnia* sp. population dynamics were monitored. In Onyar River, biological and chemical quality before and after the NBS implementation is being monitored and in Antissa, the quality of vegetables cropped with reclaimed water is being analysed. BIODAPH has shown capacity for diminishing pollutant load, but efficiencies depend on the family of pollutants and operational parameters of the NBS.

Managed aquifer recharge (MAR) as a nature-based solution (NBS) for groundwater resilience

Marga Ramis-Oliver*, Juan Miguel Rosillo-Comino, Aaron Ortega-McClear, Celso Garcia

GLOWATER, Departament de Geografia, Universitat Illes Balears, 07122 Palma, Balears, España

marga.ramis-oliver@uib.cat

This study presents a systematic review of the literature published between 1980 and the present, with the aim of analyzing how, where, and for what purposes MAR/NBS interventions have been implemented or studied in aquifers and wetlands of Mediterranean regions, identifying trends, knowledge gaps, and opportunities for more sustainable management. The bibliographic search, conducted in Web of Science, identified 74 publications that meet the established criteria: MAR/NBS studies with a defined hydrological function, linked to infiltration processes or to interactions with groundwater in Mediterranean climate contexts. Studies focused on natural ecosystems without water treatment, exclusively ecological studies, and those that do not include constructed systems or measurable applications, among others, were excluded. After completing the systematic screening process, the selected studies were classified according to several analytical categories, including their nature (operational, pilot, or conceptual), geographic location, type of system studied, and methodology used. The results show a notable concentration of cases in western Mediterranean countries, as well as a predominance of interventions aimed at aquifer recharge and a sustained increase in publications since 2010. The bibliometric analysis also highlights the presence of highly cited articles that have helped structure the conceptual framework of the field. Overall, these trends indicate that MAR/NBS interventions in Mediterranean climates constitute a rapidly evolving field, with methodologies still under development and new approaches continuing to emerge. At the same time, their implementation reflects diverse rates and degrees of adoption depending on the regional context, highlighting the dynamism and heterogeneity of this field of research and practice.

Effects of water flow reduction and fine sediment deposition on microbial structure and function

Neus Besolí-Mestres[1,2]*, Paula Esparraguera[1], Anna Freixa[1], Sergi Sabater[1,2]

[1]Catalan Institute for Water Research (ICRA), Carrer Emili Grahit, 101, Parc Científic I Tecnològic de la Universitat de Girona, 17003, Girona, Spain. [2]University of Girona, Plaça de Sant Domènec, 3, 17004 Girona, Spain

nbesoli@icra.cat

Mediterranean rivers are naturally adapted to water flow intermittency, low summer flows and autumnal floods. However, water diversion or damming also alters these natural hydrological and sediment dynamics and may push these systems beyond their natural operating range, with unknown short- and long-term consequences. Using a laboratory experiment with artificial channels, we assessed the combined effects of fine sediment deposition and reduced flow on microbial structure and function. The reduction from higher to lower water velocity (from 5 cm s^{-1} to 1 cm s^{-1}) would drastically affect the hydraulic conditions at the streambed and promote varying levels of fine sediment deposition, thus affecting the biological structure and functions of microbial communities. We examined how this environmental stress affected the community structure, primary production, microbial respiration, and organic matter decomposition of stream biofilms. By performing a sequential experiment design, we identified a water flow threshold at which sediment mobilization and deposition shift. We anticipate that low-flow conditions, associated with sediment deposition, primarily affect microbial primary production and respiration due to sediment clogging and reduced light availability, while enzymatic activity may also be impaired. This experiment illustrates the implications of dynamism loss on the structure and functioning of the basal biological components in rivers submitted to strong hydrosedimentary pressures.

Habitat position shapes the quantity and biodegradability of woody litter–derived DOM in a saline fluvial–riparian ecosystem

Rosa Gómez[1]*, Zeus Freixinos[2], Anna Romaní[3], Andrea Butturini[4], María del Mar Sánchez- Montoya[5], María Isabel Arce[6]

[1]Dpto. Ecología e Hidrología, Universidad de Murcia. 30100, Murcia, Spain. [2]Dpto. Ecología e Hidrología, Universidad de Murcia. 30100, Murcia, Spain. [3]Institute of Aquatic Ecology, University of Girona, Spain. [4]Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Universitat de Barcelona, Barcelona, Spain. [5]Department of Ecology, Universidad Autónoma de Madrid, Campus de Cantoblanco, 28049, Madrid, Spain. [6]Dpto. Ecología e Hidrología, Universidad de Murcia. 30100, Murcia, Spain.

rgomez@um.es

Decomposing woody litter from shrubs in arid and semiarid watersheds can represent an important terrestrial source of dissolved organic matter (DOM) for both terrestrial and aquatic ecosystems, yet its role has received little attention. After flood events, woody litter often remains distributed along the lateral gradient of semi-arid streams, where exposure to contrasting environmental conditions—including salinity—may influence both the production of leachable DOM and its chemical composition, with potential consequences for DOM bioavailability. Here, we examined how habitat position affects woody litter decomposition and the quantity, composition, and biodegradability of leached DOM. Litterbags containing stems of Sarcocornia fruticosa (1–3 mm diameter) were deployed in three habitats—stream channel, shoreline, and floodplain—for nine months. Stems were retrieved after 96, 152, and 273 days to assess changes in litter chemical composition. Simultaneously, DOM was extracted to estimate the potential yield of leachable DOC, N, and P, as well as DOM composition and bioavailability. Our results reveal strong variability in leachate chemistry and DOM bioavailability throughout decomposition, modulated by habitat conditions. Contrary to patterns commonly reported for leaf litter, stems at advanced stages of decomposition may act as a substantial source of DOC and nutrients, producing DOM with bioavailability comparable to that derived from fresh stems. These findings indicate that the spatial and temporal dynamics of woody litter–derived DOM, including its quantity, quality, and biodegradability, cannot be generalized without considering litter type (leafy or woody), decomposition stage, and habitat context. Habitat-driven shifts in the composition of the microbial decomposer community, also affected the bioavailability of leachable DOM. Overall, our study highlights the importance of these factors in determining the role of woody litter as a source of energy and nutrients, with implications for nutrient limitation and biogeochemical processes in arid and semiarid fluvial-riparian ecosystems.

Extreme pulses of nutrients and organic matter lead to long-lasting effects on extracellular enzyme activities

Nuria Perujo[1]*, Simon Wentritt[2], Majd Muwafaq[3], Ingrid Sassenhagen[4], Kevin Jones[5], Johanna Sjoestedt[5], Silke Langenheder[6]

[1]GRECO-Research group on inland Waters, Institute of Aquatic Ecology (IEA), Universitat de Girona, 17003, Girona, Spain. [2]Helmholtz Centre for Environmental Research (UFZ), Magdeburg, Germany. [3]University of Debrecen, Hungary. [4]Leibniz Institute for Baltic Sea Research Warnemünde, Rostock, Germany. [5]Lund University, Lund, Sweden. [6]Uppsala University, Uppsala, Sweden

nuria.perujo@udg.edu

Global change is increasing the frequency and intensity of heavy precipitation events, which can enhance runoff and nutrient and organic matter inputs into aquatic ecosystems. These inputs may promote eutrophication, algal blooms, and brownification, threatening water quality and ecosystem functioning. Microbial extracellular enzyme activities (EEAs) play a key role in the degradation of dissolved organic matter and nutrient cycling. However, it remains unclear how the frequency and intensity of nutrient and organic matter pulses shape the immediate and long- lasting effects on EEAs related to carbon, organic nitrogen and organic phosphorus degradation. The present study aims to analyze the immediate and long-lasting microbial response of EEAs to the combined addition of nutrients and organic matter following pulses of different intensity and frequency. To achieve that, an outdoor mesocosm experiment was conducted at Lake Erken, Sweden, in Spring 2023. A total of 16 mesocosms were placed inside the lake and filled with unfiltered lake water. A total of four treatments were created: 'extreme' (a single large pulse addition), 'intermittent" (7 pulses of variable intensity), 'daily" (daily pulses of lower intensity) and 'control' (without any additions). The experiment ran for 37 days and was divided into the simulated rainfall period (20 days) and the post-rainfall period. Water sampling for EEA determination was performed every fourth day for a total of 10 samplings. Main results show an estimulation of enzymatic activities in all runoff scenarios with daily and intermittent treatments showing more similar responses between them. Interestingly, P-related enzyme was mostly affected by daily pulses, whereas C-related enzymes responded more strongly to the extreme pulse. At the end of the experimental period, C-related enzymes remained enhanced in all treatments, revealing a sustained stimulation of the organic matter decomposition beyond the post-rainfall period.

Ten essential steps to achieve gender equality in academia through scientific societies

Ana Genua-Olmedo[1,2], Sílvia Poblador[1,3], Judit Lecina-Diaz[1,4], María Mar Sánchez- Montoya[1,5], Pablo Rodríguez-Lozano[1,6], Mireia Bartrons[1,7], Elena Hernández del Amo[1,8], María Anton-Pardo[1,9], Núria Catalán[1,10]*, Ada Pastor[1,11], Miguel Cañedo-Argüelles[1,12], Anna Freixa[1,13], Susana Bernal[1,10]

[1]Grupo Gender & Science, Asociación Ibérica de Limnología, Mislata, Valencia, Spain. [2]Tragsatec, Madrid, Spain. [3]Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Universitat de Barcelona, Spain. [4]Technical University of Munich, TUM School of Life Sciences, Ecosystem Dynamics and Forest Management Group, Hans-Carl-von-Carlowitz-Platz 2, 85354, Freising, Germany. [5]Department of Biodiversity, Ecology and Evolution, Complutense University of Madrid, 28040, Madrid, Spain. [6]Departamento de Ecología, Universidad Autónoma de Madrid, Madrid, Spain. [7]Aquatic Ecology Group, University of Vic - Central University of Catalonia, 08500 Vic, Spain. [8]Departament de Genètica i Microbiologia, Universitat Autònoma de Barcelona, Spain. [9]Institut Cavanilles de Biodiversitat i Biologia Evolutiva, Universitat de València. [10]Centre d'Estudis Avançats de Blanes, CEAB-CSIC. [11]Group of Continental Aquatic Ecology Research (GRECO), Institute of Aquatic Ecology, University of Girona, Girona, Spain. [12]FEHM-Lab (Freshwater Ecology, Hydrology and Management), SHE-2, Institute of Environmental Assessment and Water Research (IDAEA), CSIC, Carrer de Jordi Girona, 18-26, 08034 Barcelona. [13]Catalan Institute for Water Research (ICRA-CERCA)

nuria.catalan@ceab.csic.es

The gender gap in Science, Technology, Engineering, and Mathematics (STEM) disciplines remains a persistent and widespread global issue. Scientific societies can play a pivotal role in addressing this gap in academia by promoting gender equity through collaboration, advocacy, and leadership. However, the positive impact that scientific societies can have on reducing gender biases is poorly assessed. The main objective of this contribution is to encourage scientific societies to take proactive measures to raise awareness and implement strategies that promote gender equity within academia. We analyzed gender gaps on executive boards and the presence of gender groups, focusing on freshwater scientific societies. These two elements respectively represent top-down and bottom-up organizational tools for promoting transformative change. Then, we delve into the insights from over a decade of experience addressing gender biases as members of the Gender and Science group within the Iberian Association of Limnology (AIL). Drawing from this experience, as well as the work of other gender and inclusivity groups, we propose 10 actionable steps supported by specific examples to empower scientific societies and their members to make meaningful progress in advancing gender equity. We highlight key obstacles to implementing these actions and calls on societies to actively foster gender equity within academia and beyond.

Los derechos de la naturaleza: el caso del Mar Menor, las mujeres y Teresa Vicente

Elizabeth Leon-Palmero, Maria del Mar Sánchez-Montoya, Belén Franco-Cisterna, Pablo Rodríguez-Lozano, Ángeles G. Mayor, Ana Genua-Olmedo, Susana Bernal, Clara Mendoza-Lera, Núria Catalán, Anna Lupon, Sílvia Poblador, Miguel Cañedo-Argüelles, Teresa Vicente Giménez, Maria Rosario Vidal-Abarca

Grupo de Género y Ciencia de la Asociación Ibérica de Limnología (GyC-AIL)

charyvag@um.es

A medida que las actividades humanas deterioran los ecosistemas y agravan el cambio climático, en Occidente ha tomado fuerza un enfoque ambiental basado en el desarrollo sostenible y los servicios ecosistémicos como vía para proteger la naturaleza. Pero este enfoque centrado en el beneficio humano resulta insuficiente. Se plantea, avanzar hacia marcos ecocéntricos, ya presentes en muchas culturas del Sur Global, que reconozcan el valor intrínseco de la naturaleza. En ese contexto, los Derechos de la Naturaleza son una herramienta para fortalecer la protección de los ecosistemas mediante su reconocimiento legal como sujetos de derechos. En esta comunicación se analiza el caso del Mar Menor, la laguna salada más grande de Europa, situada en el sureste de la Península Ibérica, una región caracterizada por una aridez creciente y un déficit hídrico estructural agravado por la intensificación del regadío y el cambio climático. El Mar Menor conforma un socio-ecosistema vulnerable donde las presiones agrícolas, urbanísticas y turísticas han provocado episodios recurrentes de eutrofización, mortandad masiva de organismos acuáticos, y colapso ecológico. Ante esta crisis y la ineficacia de las instituciones para proteger al ecosistema, la ciudadanía se movilizó reivindicando un “Mar Menor vivo”. Las mujeres fueron parte central y estuvieron al frente de la movilización y la denuncia. La ciudadanía impulsó una Iniciativa Legislativa Popular, liderada por la profesora Teresa Vicente, para otorgar derechos propios a la laguna. Esta ley constituye un hito sin precedentes en el ordenamiento jurídico español y europeo, al reconocer por primera vez a un ecosistema y su cuenca como un sujeto pleno de derechos y no como un mero objeto de protección.

Macroinvertebrate assemblages after 14 years of pondscape degradation in a UNESCO World Heritage Site: the Influence of connectivity, environmental changes and Invasive Non-Native Species

Christian Arnanz[1,2,3]*, Pablo Soto-García[2], David Aragonés[1], Miguel de Felipe[1], Carmen Díaz-Paniagua[1], Carlos Melian[4], María del Carmen Ramírez-Soto[1], Laura Serrano[5], Margarita Florencio[1]

[1]Estación Biológica de Doñana, Consejo Superior de Investigaciones Científicas, Spain. [2]Inland-Water Ecosystems Team (I-WET), Departamento de Ecología, Universidad Autónoma de Madrid, Spain. [3]Centro de Investigación en Biodiversidad y Cambio Global (CIBC-UAM), Universidad Autónoma de Madrid, Spain. [4]Department of Fish Ecology and Evolution, EAWAG Center for Ecology, Evolution and Biogeochemistry, Switzerland. [5]Departamento de Biología Vegetal y Ecología, Universidad de Sevilla, Spain

christian.arnanz@estudiante.uam.es

Doñana National Park, a UNESCO Site, faces mounting pressures such as climate change, agricultural intensification (e.g. groundwater abstractions, nutrient pollution), and biological invasions, resulting in a progressive pondscape degradation. Through a longitudinal approach, this study examines how macroinvertebrate assemblages have responded to these changes after a 14-year period, comparing field data from two years with wide differences in pond flooding (2007 and 2021) across the Doñana pond network. We combined species-patch network analysis with community graph-based approaches and beta-diversity modelling to assess how connectivity, environmental, and biotic factors (invasive non-native species, INNS) shaped community change. Structural analysis of species-pond networks revealed that the majority of links lost over the study period were attributable to local extinctions within persistent ponds rather than to pond loss alone, suggesting ongoing community erosion beyond simple habitat reduction. Assembly patterns showed limited nestedness in both years, with stochastic processes playing a dominant role, more so in 2021. Species richness and Local Contribution to Beta Diversity (LCBD) were modelled using Poisson GLMs and beta regression. Percolation distance-based metrics consistently outperformed community contingent-based metrics, and key drivers differed between years: conductivity and P. clarkii presence were important in 2021 but not in 2007. Variance partitioning indicated that approximately 18% of LCBD variation was explained by centrality metrics, pond typology, environmental conditions, and INNS (*P. clarkii* and *G. holbrooki*), with the latter two as dominant components. Increment in conductivity and *P. clarkii* colonisation were the only significant predictors, both positively associated with LCBD, whilst dissolved inorganic phosphorus and turbidity showed negative, non-significant trends, suggesting a dual dynamic of ecological divergence and incipient biotic homogenisation. These findings highlight the compounding effects of pond loss and environmental degradation on macroinvertebrate diversity in Mediterranean temporary ponds, as protected habitats (Habitat Directive, code 3170), with implications for the conservation of threatened pondscapes.

Inferring agricultural impacts on aquatic biodiversity in farmland ponds and assessing ecological recovery following restoration

Eftesum Eftesum*, Carl D. Sayer, Helen Bennion

Pond Restoration Research Group, Environmental Change Research Centre, Department of Geography, University College London, WC1E 6BT, London, UK

eftesum.eftesum.16@ucl.ac.uk

Farmland ponds are aquatic ecosystems embedded in agricultural landscapes. The ponds have been a very historic part in British agricultural landscapes for centuries. They provide a wide array of habitats and refuges for aquatic and terrestrial biodiversity encompassing plants, invertebrates and vertebrates. These ponds are ecologically significant for biodiversity conservation despite their size, yet remain threatened by many factors, namely, agricultural intensification, pond terrestrialization, cessation of traditional pond management practices, pond loss and land reclamation, etc. During 1960-1970s with the agricultural intensification, it is widely thought that many lowland UK ponds started to become overgrown by scrubs and trees due to the cessation of traditional pond management practices, rendering them low in terms of aquatic biodiversity and in need of restoration. Aiming to inform the restoration and conservation of aquatic biodiversity in English farmland ponds, this research is employing palaeoecological technique to investigate long-term changes in pond ecosystems through a multi-pond approach, especially due to pond terrestrialization and past pond management events. Using plant and animal macrofossil analysis, the project will examine post-restoration success on returning pre-terrestrialization wetland plant communities to restored ponds as well as determining the extent to which multiple ponds in the same areas were managed in the past. Three farmland ponds in Heydon (a village in Norfolk, eastern England) have been selected for the study. The long-term data afforded by pond sediment cores analysed for plant and animal macrofossils will afford decadal-centennial level information on the occurrence, trajectory and nature of ecological changes in ponds in the context of past pond management practices, natural successional processes and on-going as well as future pond restoration. The project is crucial in terms of conservation success and historical appropriateness of conservation work involving scrub management in farmland ponds which are largely untouched resources in the UK agricultural landscapes.

Effects of partial fencing in mountain ponds to reduce livestock impact.

Lena Fehlinger[1,2]*, Dani Boix[3], Sandra Brucet[1,2,4]

[1]Aquatic Ecology Group, Universitat de Vic UVic-UCC, Vic, Spain [2]Fundació Bionexus, Girona, Spain [3]Institute of Aquatic Ecology, Universitat de Girona, Girona, Spain [4]ICREA, Catalan Institution for Research and Advanced Studies, Barcelona, Spain

lena.fehlinger@gmail.com

Mountain ponds are ecologically important small water bodies, that are both highly relevant for aquatic biodiversity and as providers of ecosystem services to humans, including water provision. Livestock rearing is an important agricultural sector in mountainous areas, where particularly during summer pasturing, large amounts of water are necessary to maintain livestock fitness. While low-intensity livestock grazing can be beneficial for mountain ecosystems, intense livestock pressure on mountain ponds can lead to severe issues. These can include microbial contamination or destruction of riparian and aquatic vegetation, posing a threat to many aquatic organisms. We assessed the immediate response of macroinvertebrates and submerged macrophyte cover to partial fencing, which prevented livestock from accessing one side of the fenced ponds. The management was implemented following a Before-After Control-Impact (BACI) design, to reliably evaluate effectiveness of the management measure. We included six permanent and six temporary ponds in the Pre-Pyrenees of Spain in the experiment, and fenced three of each pond category, while maintaining the other six ponds as completely unfenced control ponds. Results showed that macroinvertebrate richness and abundances, and submerged macrophyte cover were consistently higher in the fenced sides of permanent mountain ponds. Due to drought conditions and ponds falling dry during the resampling campaigns, the results from temporary ponds were less clear, however, in the sampled temporary ponds, trends were similar to the permanent ponds. This underlines the value of partial fencing of mountain ponds which supports increased aquatic biodiversity, with observable effects starting shortly after installation.

Three decades of monitoring of the Doñana pondscape (SW Spain): evidence of deterioration and conservation implications

Margarita Florencio[1]*, Christian Arnanz[1,2,3], Laura Serrano[4], Pablo Soto-García[2], María del Carmen Ramírez-Soto[1], Marina Tomás-Martín[2,3], Isabel M. García[1], Vanesa Céspedes[1], Miguel de Felipe[1], Rocío Fernández-Zamudio[1], David Aragonés[1], Carmen Díaz-Paniagua[1]

[1]Estación Biológica de Doñana, Consejo Superior de Investigaciones Científicas, Spain [2]Inland-Water Ecosystems Team (I-WET), Departamento de Ecología, Universidad Autónoma de Madrid, Spain [3]Centro de Investigación en Biodiversidad y Cambio Global (CIBC-UAM), Universidad Autónoma de Madrid, Spain [4]Departamento de Biología Vegetal y Ecología, Universidad de Sevilla, Spain

margarita@ebd.csic.es

Mediterranean temporary ponds (MTPs) are priority habitats for conservation under the European Union Habitats Directive (code 3170). Doñana National Park (UNESCO World Heritage Site and Ramsar Site) includes one of the largest and most protected pond networks in Europe, largely composed of MTPs, which are dependent on groundwater discharge. However, the deterioration of the Doñana pond network during the last decades has been followed by a decline in its unique biodiversity. To understand the long-term environmental changes affecting this pondscape, we have compiled a dataset of physicochemical (e.g., electrical conductivity, pH) and water quality variables (e.g., nutrient concentrations) spanning the last three decades. Additionally, we have analysed the variation of these variables using the same 63 ponds sampled across the Doñana National Park in two years with wide differences in pond flooding and hydroperiod, 2007 and 2021. In general, we have detected an increase in the electrical conductivity in 2021. Also in 2021, we have found some sites where the ratio of the total phosphorous (P) concentration over the particulate P concentration in the water column was >2, suggesting a severe anthropogenic eutrophication as the sediment P-binding capacity has become saturated under a long-term P load. The wide range and variability of the hydroperiod gradient characterizing the pond network in 2007 have been notably reduced in 2021, suffering the loss of the most ephemeral and short-hydroperiod ponds, shortening those with a longer hydroperiod and reducing their flooded area, and drying up even the permanent ponds in summer. The severe piezometric decline of the aquifer that feeds the Doñana ponds is presently threatening the hydroregime of the ponds. It is necessary and urgent to cease groundwater over-exploitation in order to preserve the singularity and diversity of this vulnerable pond network.

Evaluando la restauración de las lagunas costeras de Les Madrigueres (Baix Penedès, Tarragona): estado ecológico y seguimiento de las comunidades de macroinvertebrados

Milagros Bodega Marchesini, Manuel Pinilla-Rosa, Margarita Menéndez*

Department of Evolutionary Biology, Ecology and Environmental Sciences, Universitat de Barcelona, Spain

mmenendez@ub.edu

A pesar de cubrir solo el 6% de la superficie terrestre, los humedales son uno de los ecosistemas con mayor biodiversidad del planeta. No obstante, se estima que el 50% de su extensión global ya ha desaparecido, y su degradación continúa, debido principalmente, a presiones antrópicas. El área de restauración "Les Madrigueres" comprende 30 hectáreas de la última franja litoral no urbanizada del Baix Penedès (Tarragona). Este espacio albergaba, en el pasado, dos lagunas costeras y marismas relacionadas con la desembocadura de una rambla efímera, la riera de La Bisbal, las cuales fueron desecadas tras el desvío y canalización del cauce para usos agrícolas. Debido a esto, a partir del año 2015 se fueron creando sucesivamente hasta 5 lagunas costeras: una creada en 2015 y ampliada en 2017, tres más creadas en 2017, una de ellas colmatada hoy en día, y la más reciente en 2025, con el fin de recuperar la funcionalidad ecológica y la biodiversidad que históricamente existió en este espacio. El objetivo del presente trabajo es evaluar el estado ecológico de estas lagunas. Para ello se medirán las características físico-químicas y se realizará un muestreo de la comunidad de macroinvertebrados desde octubre de 2025 a abril de 2026, con un muestreo adicional de peces y microcrustáceos en abril de 2026. Luego se compararán estos resultados con datos tomados en años anteriores con una metodología similar, para contrastar la evolución de cada sistema, identificando las variables que influyen en su desarrollo y brindando herramientas para la planificación de su gestión. Bajo la hipótesis de que el tiempo de maduración, la hidrología y la complejidad del hábitat (presencia de vegetación y fauna acompañante) condicionan la colonización biológica de macroinvertebrados acuáticos, se espera hallar diferencias significativas en la composición de las comunidades entre estas cuatro lagunas.

Land recovery and stream conservation: Evaluation of the ecological status of streams after 47 years of regeneration in the Tropical Andes

Blanca Ríos-Touma[1]*, Andrés Morabowen[1], María Gallardo[2,3], Christian Villamarín[4], Andrés Castañeda[4], Emilia Ayala[2], Soledad Pereira[2], Francisco Cuesta[2]

[1]Colegio de Ciencias Biológicas y Ambientales; Global Research & Solutions Center, Universidad San Francisco de Quito, 170901, Ecuador [2]Decanato de Investigación; Global Research & Solutions Center, Universidad San Francisco de Quito, 170901, Ecuador [3]Aglomerados Cotopaxi, 050153, Lasso, Ecuador [4]Grupo de Investigación en Biodiversidad, Medio Ambiente y Salud (BIOMAS), Universidad de Las Américas, 170135, Quito, Ecuador

briost@usfq.edu.ec

Páramo ecosystems stretch along the high Tropical Andes, from Venezuela to Peru, including *Polylepis* woodlands and peatlands. They provide vital services, including water regulation, carbon storage, and biodiversity refugia. Organic soils retain and slowly release precipitation, stabilizing flows, with cold, wet conditions slowing decomposition and boosting soil organic carbon accumulation. However, agriculture, grazing, and burning degrade páramos and woodlands, reducing diversity, altering ecosystems, and threatening water quality and supply. We assessed aquatic biodiversity, ecological condition, and source-water quality in 21 headwater streams draining a conservation mosaic established 47 years ago in an area formerly used for livestock (extensive grazing) that included the use of fire and agriculture. We measured in situ physicochemical variables, including pH, specific conductivity, dissolved oxygen, discharge, substrate, and instream habitat. We measured bio-ecological indicators: fecal coliforms, aquatic macroinvertebrates, and riparian condition. We analyzed water samples for ammonium, nitrate, phosphate, and 23 trace metals plus phosphorus. Results were compared with standards for raw water sources intended for human consumption (pre-treatment). Macroinvertebrate-based biological quality (ABI) and diversity (Hill N1) were uniformly high: 100% of sites were rated Very Good or Excellent. In contrast, an integrated ecological quality metric combining riparian condition (QBR-And) and macroinvertebrates showed strong spatial variation. Overall, 50% of reaches had Good to Very Good ecological quality, while 25% were Regular and 25% were Poor. Lower-quality reaches were consistently associated with riparian degradation linked to livestock access (bank trampling and loss of native vegetation), water-intake infrastructure, and elevated fecal coliforms. In some cases, replacement of native riparian vegetation by exotic plantations further reduced ecological quality despite high macroinvertebrate scores. Most measurements of metals and in situ chemistry met applicable standards, indicating low chemical contamination risk. Our results identify riparian condition as the main driver of ecological impairment and support targeted actions, including riparian restoration, livestock exclusion, and micro-watershed land-use management, to safeguard water provision for human consumption and agricultural production, and unique biodiversity under increasing global environmental change.

Managing and Restoring Mediterranean Ponds as Nature-Based Solutions for climate change mitigation and adaptation: a technical manual

Serena Sgarzi[1,2]*, Alejandro López-de Sancha[1], Lluís Benejam[1], Dani Boix[3], Sandra Brucet[1,2,4]

[1]Universitat de Vic – Universitat Central de Catalunya, Vic, Spain. [2]Fundació Privada Bionexus, Girona, Spain. [3]GRECO, Institute of Aquatic Ecology, Universitat de Girona, Girona, Spain. [4]Catalan Institution for Research and Advanced Studies (ICREA), Barcelona, Spain

serena.sgarzi@uvic.cat

Mediterranean ponds, despite their small size, are hotspots of biodiversity, habitat of endemic species, and provide critical ecosystem services. However, they remain underrepresented in land-use planning, applied research, regulatory policies and management strategies. In the context of climate change, agricultural intensification and urban expansion, these highly vulnerable ecosystems require specific technical tools and protocols adapted to their unique hydrological and ecological dynamics. We developed a 'Technical Manual for the Management, Restoration, and Creation of Mediterranean Ponds' that provides practical guidance to managers, public authorities, technicians, NGOs, and other professionals engaged in their conservation and restoration. It adapts principles developed under the European PONDERFUL project to the Mediterranean context, addressing key ecological features: highly variable hydroregime, high sensitivity to diffuse pollution, vulnerability to invasive species, and strong dependence on climatic regimes. The handbook frames Mediterranean ponds and pondscapes as strategic Nature-Based Solutions, positioning them as multifunctional green infrastructures that contribute to biodiversity enhancement, flood mitigation, nutrient retention, water storage, climate adaptation, and human well-being. It promotes a landscape-scale (pondscape) approach, assigning complementary functional roles to different ponds to maximize ecosystem services and Nature's Contributions to People. Grounded in Nature-based Solution principles, the manual provides a strategic framework for restoration and creation, integrating ponds into broader ecological restoration and climate adaptation strategies. In line with the 2024 Nature Restoration Law, it underscores the need for systematic monitoring, management, and restoration within a global change perspective.

Naturalized urban ponds in Barcelona: insights from interdisciplinary research

Daniel von Schiller[1]*, Sergi Valera[1], Alberto Maceda-Veiga[1], Xavier Fernández-Cassi[1], Magdalena Alcover-Amengual[1], Francesc Sabater[1], Tomeu Vidal[1], Biel Obrador[1], Isabel Muñoz[1], María Jesús Montes-López[1], Ignasi Estarlich[1], Angela Castrechini[1], Miquel A. Arnedo[1], Cesc Múrria[1], Joan Gomà[1], Laura Barahona[2], Tomás Montalvo[2], Mikel Subiza-Pérez[3], Javier Martínez-López[4], Nuria Pistón[4], Domingo Alcaraz-Segura[4] , Regino Zamora[4]

[1]Universitat de Barcelona, Barcelona, Spain. [2]Agència de Salut Pública de Barcelona, Barcelona, Spain. [3]Basque Centre for Climate Change, Leioa, Spain. [4]Universidad de Granada, Granada, Spain

d.vonschiller@ub.edu

As urban areas continue to expand, they are becoming key arenas for social, economic, and environmental transformation. In response, many cities are increasingly incorporating natural elements into urban design to promote sustainability and resilience. Within this context, the naturalization of artificial ponds has emerged as a promising nature-based solution. Naturalized urban ponds (NUPs) can support the ecological transition of cities by delivering multiple societal and environmental benefits through cost-effective and sustainable management. This presentation showcases the objectives and selected results of previous and ongoing interdisciplinary research on NUPs in Barcelona, and introduces the newly launched CLIMABLUE project. Our work examines the factors shaping biodiversity in NUPs, as well as their potential to contribute to more sustainable urban water management. We also investigate their role in biogeochemical cycling, with particular attention to greenhouse gas fluxes and pollutant attenuation. In addition, we assess the social and public health dimensions of these systems, including human perceptions and potential benefits and disbenefits for health and well- being. Overall, our findings indicate that naturalized urban ponds can enhance urban biodiversity, improve environmental quality, and generate meaningful co-benefits for human health and well-being. By integrating ecological, biogeochemical, and social perspectives, this research highlights the potential of NUPs as multifunctional infrastructures and as a valuable component of more sustainable and climate-resilient urban landscapes.

Estimation of phycocyanin and cyanobacterial biomass using in situ radiometry

Bárbara Alvado*, Xavier Sòria-Perpinyà, Antonio Ruíz-Verdú, Jesús Delegido

Image Processing Laboratory, Universitat de València, Catedràtic Agustín Escardino Benlloch 9 E4, Paterna, Spain

Barbara.Alvado@uv.es

Monitoring water quality in inland waters has become increasingly important due to the proliferation of harmful algal blooms (HABs), particularly those dominated by cyanobacteria. Phycocyanin (PC), an accessory pigment characteristic of these organisms, is a key bioindicator for estimating their concentration and biomass. In this context, the development of spectral indices for remote estimation using hyperspectral sensors represents an advance in water quality monitoring. PC has an absorption range around 620 nm, and its detection can be optimized by developing indices based on band ratios. Retrieval of the algorithms was made using datasets from projects conducted on reservoirs and lagoons in the Iberian Peninsula (Spain). Based on in situ radiometry data (convolved to the bands of hyperspectral sensors PRISMA and EnMAP), and in situ PC data, band combinations were obtained, correlating them through the best fitting function for 61 water samples. To standardize the model, a common index was sought for both sensors, finding that the best option is a triband index with 714, 620, and 704 nm (R2 = 0.60 for PRISMA, 0.65 for EnMAP). The production of certain cyanobacterial toxins is closely related to the amount of its biomass. The cyanobacterial biomass was estimated indirectly, through the correlation between PC and cyanobacterial biomass in situ. Although PC does not directly correspond to toxin levels, has been shown to be more correlated with certain toxins than other optical proxies, including Chla. Applying the phycocyanin estimated by the model to the equation obtained, the following results were obtained: R2 = 0.50, NRMSE = 24%, and bias = 5.4 mg/L for PRISMA; R2 = 0.49, NRMSE = 32%, and bias = 4 for mg/L EnMAP. The development of these indices improves the detection of cyanobacterial blooms, optimizes water resource management and strengthens environmental warning systems at regional levels.

Gemelos digitales y observaciones de alta resolución temporal aplicados al estudio de la dinámica del oxígeno disuelto en embalses hipertróficos

Agustin Monteoliva[1]*, Concha Durán[2], Cintia Luz Ramón[3], Alicia Cortés[3], Sergio López-Padilla[3], Nuria Pérez[3], Francisco José Rueda[3]

[1]ECOHYDROS S.L., Polígono Industrial de Cros, Edif 5-Nave 8, 39600, Maliaño, Cantabria, Spain. [2]Confederación Hidrográfica del Júcar, Pl. San Juan de Dios, 3, 03010 Alicante, Valencia, Spain. [3]Universidad de Granada, Departamento de Ingeniería Civil, Calle Doctor Severo Ochoa s/n, 18001, Granada, Spain

apmonteoliva@ecohydros.com

El embalse de Bellús (Confederación Hidrográfica del Júcar, CHJ) es un sistema hipertrófico con recurrentes eventos de anoxia, proliferación masiva de cianobacterias potencialmente tóxicas y mortandad de peces. Las poblaciones aguas abajo se encuentran expuestas a malos olores asociados al desembalse del agua al río Albaida. Para controlar la calidad del agua desembalsada, la CHJ ha implementado un sistema de extracción selectiva, compuesto por una estructura multitoma y sondas multiparamétricas montadas sobre un perfilador, ubicado en una plataforma flotante. Sin embargo, faltan criterios que guíen la explotación de esta infraestructura y maximicen la concentración del oxígeno disuelto en el agua desembalsada sin deteriorar las condiciones biogeoquímicas en el embalse. El objetivo de este trabajo es desarrollar un gemelo digital que permita predecir la evolución y distribución vertical de temperatura, nutrientes, oxígeno disuelto y abundancia de cianobacterias, en respuesta a estímulos externos (cargas de nutrientes externas e internas, forzamiento hidrometeorológico) y estrategias de gestión de la estructura multitoma. Se presentan resultados preliminares de este modelo. Se realizaron simulaciones de la estructura térmica del embalse a dos escalas temporales con resultados satisfactorios. A largo plazo (2001-2024), simulaciones con resolución diaria fueron validadas con perfiles históricos (mensuales) de temperatura e imágenes LANDSAT. Las simulaciones a corto plazo (2023-2024) con resolución horaria se contrastaron con datos obtenidos cada 6 h por el perfilador automático. Se evaluó el efecto de distintos protocolos de extracción selectiva en la estructura térmica del embalse. Se utilizaron parametrizaciones de las demandas volumétricas/superficiales de oxígeno disuelto e intercambio con la atmósfera para simular la distribución de oxígeno disuelto en la columna de agua y su variabilidad temporal. Los resultados del modelo y los datos experimentales se utilizan para explicar la dinámica de oxígeno en Bellús, su variabilidad temporal y los eventos de anoxia completa en toda la columna de agua.

Seguimiento de la calidad del agua de lagos y embalses con teledetección usando el procesado en la nube con Copernicus Browser

Gabriel Caballero[1], Xavier Sòria-Perpinyà[1], Bárbara Alvado[1], Antonio Ruíz-Verdú[1], Juan M. Soria[2], Eduardo Vicente[2], Concha Durán[3], Damián Ortega[3], Jesús Delegido[1*]

[1]Laboratorio de Procesado de Imágenes, Universitat de València. C/ Catedrático José Beltrán, 2. Parc Científic. 46980, Paterna, València, España. [2]Instituto Cavanilles de Biodiversidad y Biología Evolutiva (ICBiBE). Universitat de València. C/ Catedrático José Beltrán, 2. Parc Científic. 46980, Paterna, València, España. [3]Confederación Hidrográfica del Júcar, Avenida de Blasco Ibáñez 48, Valencia, España

jesus.delegido@uv.es

El conocimiento de la calidad del agua en lagos y embalses no solo constituye una obligación para los gestores del agua, sino que también resulta fundamental para la evaluación del estado ecológico de estos ecosistemas, fundamentales para la biodiversidad. En este contexto, la teledetección se ha consolidado como una herramienta de gran utilidad, impulsada significativamente por el programa Copernicus de la Unión Europea. Desde 2016, este programa ha desarrollado una serie de satélites operativos que proporcionan información continua y valiosa para el monitoreo ambiental. La abundante disponibilidad de imágenes permite analizar tanto la distribución espacial como la variación temporal de diversas variables indicadoras de la calidad del agua. No obstante, la implementación operativa de procesos como el análisis de series temporales requiere el manejo de grandes volúmenes de información, lo que supera la capacidad de procesamiento de los sistemas informáticos convencionales. Para abordar esta limitación, se han desarrollado metodologías basadas en plataformas que permiten el prcesado en la nube, como Google Earth Engine y Copernicus Browser. Esta última, gestionada por la Agencia Espacial Europea (ESA), no solo facilita la descarga de imágenes con distintos niveles de procesamiento, sino que también permite generar productos avanzados y elaborar series temporales mediante programación en JavaScript. El presente trabajo se enmarca en el convenio de colaboración entre la Universitat de València y la Confederación Hidrográfica del Júcar (proyecto TELEDEMB), orientado a la estimación de la calidad del agua en lagos y embalses de la cuenca del Júcar mediante teledetección. Los resultados obtenidos, validadas con datos de campo, nos han permitido calibrar hasta el momento ecuaciones que aproximan las variables de interés en embalses de aguas claras y de aguas turbias con errores relativos en torno al 15%.

Ecological characterization of persistent cyanobacterial proliferation in a Mediterranean reservoir using high-frequency monitoring data

Susana Deus[1]*, Concha Durán[2], Alberto Criado[1], Omar Monteoliva[1], María Fernández[1], Agustín Monteoliva[1]

[1]Ecohydros S.L., Maliaño, Spain. [2]Confederación Hidrográfica del Júcar, Valencia, España. [2] Confederación Hidrográfica del Júcar, Avenida de Blasco Ibáñez 48, Valencia, España

sdeus@ecohydros.com

Cyanobacterial blooms represent a major threat to water quality and ecosystem functioning in Mediterranean reservoirs under increasing climatic and anthropogenic pressures. Bellús Reservoir (eastern Spain) has experienced persistently high phytoplankton biovolume throughout most of the year, frequently dominated by potentially harmful cyanobacteria. Understanding the ecological drivers of this proliferation is essential for effective water management. We present a comprehensive characterization of the ecological dynamics of Bellús Reservoir based on high-frequency data from an automated monitoring platform. Physical, chemical, and biological variables—including temperature, conductivity, dissolved oxygen, turbidity, chlorophyll-a, phycocyanin, and cyanobacterial biovolume—were analyzed to identify seasonal patterns and key environmental drivers associated with bloom development. Cyanobacterial biovolume remained elevated for most of the year, with recurrent events exceeding recommended alert thresholds. Strong relationships were observed between biovolume, pigment concentrations, and water column stability, indicating favorable conditions for prolonged cyanobacterial dominance. Seasonal variability was mainly driven by temperature, light availability, and mixing dynamics. We developed statistical models to transform high-frequency in situ fluorescence into quantitative estimates of cyanobacterial biovolume. Generalized additive models (GAMs) and mixed-effects approaches were used to capture non-linear relationships between sensor-derived phycocyanin signals and laboratory-determined biovolume. This framework improved the ecological interpretation of continuous monitoring data by providing robust biovolume estimates from automated platforms. Our findings highlight the high vulnerability of Mediterranean reservoirs to persistent cyanobacterial proliferation and demonstrate the value of integrating ecological analysis with sensor-based statistical modeling. This approach strengthens monitoring programs by improving the detection of critical biomass thresholds and supporting timely risk assessment and adaptive water quality management under increasing environmental stress.

Cyanobloom: advanced risk management tool for early detection and identification of toxic algal blooms

Álvaro Fanjul[1]*, Alfredo Llorente[1], Annelies Hommersom[2], Petra Philipson[3], Kerstin Stelzer[3], Milena Lazic-Tejeda[4], Alberto Agirre[1]

[1]Anbiotek SL, Erandio (Bizkaia), España. [2]Water Insight BV, Wageningen, Países Bajos. [3]Brockmann Geomatics Sweden AB, Estocolmo, Suecia. [4]Sistemas Genómicos SL, Paterna (Valencia), España

alvaro@anbiotek.com

El proyecto LIFE CYANOBLOOM (LIFE22-ENV-ES-CYANOBLOOM) desarrolla y valida un sistema integrado de alerta temprana para la detección y gestión del riesgo asociado a floraciones tóxicas de cianobacterias (HABs) en embalses y lagos destinados a abastecimiento y uso recreativo. La solución combina observación satelital, monitorización hiperespectral in situ, muestreo convencional y análisis genético dentro de un marco operativo orientado a la toma de decisiones. En el ámbito de la teledetección se han implementado algoritmos sobre datos Sentinel-2 y Sentinel-3, complementados con imágenes de muy alta resolución e hiperespectrales. Los productos satelitales han sido calibrados y validados mediante estaciones WISP desplegadas en los sitios de demostración (demo sites), permitiendo ajustar la estimación de clorofila-a, ficocianina y otros indicadores ópticos a condiciones locales. La monitorización in situ ha integrado medidas fisicoquímicas, análisis de pigmentos, estudios taxonómicos y detección molecular de genes asociados a la producción de toxinas. Esta aproximación multinivel permite relacionar señal óptica, abundancia de cianobacterias y potencial toxicidad, reforzando la evaluación del riesgo. Todos los datos se integran en un dashboard operativo que genera alertas en tiempo casi real según umbrales específicos por emplazamiento. Actualmente el sistema se encuentra en fase de validación en cuatro sitios europeos, evaluando la cadena completa detección–validación– gestión.

Predicción integrada de cantidad y calidad de agua en embalses para la gestión adaptativa frente a variabilidad climática

Daniel Mercado Bettin*, Rafael Marcé

Centre d'Estudis Avançats de Blanes (CEAB-CSIC), Blanes

daniel.mercado@ceab.csic.es

La gestión de embalses en contextos de creciente variabilidad climática representa un desafío crítico para garantizar la seguridad del agua y la calidad del recurso. Los eventos extremos, como sequías prolongadas o episodios húmedos excepcionales, afectan simultáneamente la disponibilidad y el estado ecológico del agua, incrementando la incertidumbre operativa en empresas de abastecimiento, energéticas y administraciones públicas. Por ello, aquí proponemos una predicción integrada que combina modelos hidrológicos y limnológicos para generar predicciones estacionales de variables clave de cantidad (caudales, niveles y volúmenes almacenados) y calidad (temperatura, nutrientes, oxígeno disuelto y clorofila) en embalses utilizados como fuente primaria de agua. A diferencia de enfoques tradicionales que se centran en indicadores o en análisis retrospectivos, nuestra propuesta integra información climática y de procesos ecológicos para proporcionar escenarios predictivos accionables, adaptados a las necesidades de gestores y tomadores de decisiones. La metodología se ha aplicado a casos piloto representativos, evaluando su desempeño a través de métricas de precisión y capacidad predictiva frente a observaciones reales. Los resultados demuestran que una predicción estacional integrada permite anticipar variaciones sustanciales en calidad y cantidad de agua con suficiente antelación para apoyar decisiones operativas y estratégicas, incluyendo planificación de tratamiento, gestión de reservas y preparación ante riesgos asociados al cambio climático. Este enfoque propone una solución emergente para la gestión adaptativa de embalses, enfatizando la necesidad de herramientas basadas en predicción para afrontar los desafíos ambientales actuales y futuros.

Eutrophication Risk: What Satellites Tell Us About Eutrophication Trends in Ebro Basin Reservoirs

Juan M. Soria[1]*, Juan Víctor Molner[1], Noelia Campillo-Tamarit[1], Manuel Muñoz-Colmenares[1] , Xavier Sòria-Perpinyà[2], María José Rodríguez[3]

[1]Cavanilles Institute of Biodiversity and Evolutionary Biology, Universitat de València, Catedrátic José Beltrán Martinez, 2, 46980 Paterna, Spain. [2]Image Processing Laboratory, Universitat de València, Catedrátic Agustín Escardino, 9, 46980 Paterna, Spain. [3]Ebro Basin Authority, Ministry for the Ecological Transition and the Demographic Challenge. Spanish Government. P. Sagasta, 24-28. 50007 Zaragoza, Spain

juan.soria@uv.es

The risk of eutrophication in freshwater bodies is a fact of relevant interest for the European Union and for the Government of Spain, which recently approved Royal Decree 47/2022 on the protection of waters against diffuse pollution caused by nitrates from agricultural sources. The assessment of this risk is carried out based on three classic variables in Limnology: chlorophyll- a concentration, total phosphorus and water transparency, based on the well-known Carlson Trophic State Index proposed 50 years ago and the methodology and protocols described in Royal Decree 87/2015. In order to carry out the planned monitoring, the Water Quality area of the Ebro Basin Authority is testing the possibility that it can be carried out by Remote Sensing, for which thirteen reservoirs have been selected where the variables of interest are estimated by analysing Sentinel-2 images in almost real time. To this end, through an agreement with the University of Valencia, plus the data collected by the Ebro Basin itself and its collaborating companies, equations have been established and validated to calculate chlorophyll-a concentration, water transparency, suspended matter and cyanobacteria biovolume. The results are presented in the form of thematic maps for the different dates of the year and calculated variables that provide an overview of the spatial and temporal heterogeneity of the results, which can be consulted by a web service available at the address https://satebro.es on an adaptive web page, whose design automatically adjusts its structure, images and texts to offer optimal visualization on any device: computers, tablets or smartphones. To do this, it uses flexible grids and stylesheet media queries (CSS) to reorder elements, ensuring excellent user experience, eliminating the need to create separate websites. The service is updated weekly with new images obtained from the European Space Agency's (ESA) Copernicus Browser portal.

Retrieval of phytoplankton taxonomy from hyperspectral reflectance. Application to PRISMA and EnMAP satellite data in inland waters

Antonio Ruiz-Verdú[1]*, Carolina Tenjo[1], Xavier Sòria-Perpinyà[1], Bárbara Alvado[1], Eduardo Vicente[2], Jesús Delegido[1], José Moreno[1]

[1]Image Processing Laboratory, Universitat de València, Catedràtic Agustín Escardino Benlloch 9 E4, Paterna, Spain. [2]Cavanilles Institute of Biodiversity & Evolutive Biology, Universitat de València, Catedràtic José Beltrán Martínez 2, Paterna, Spain

antonio.ruiz@uv.es

The bio-optical model PHYBOM was applied to generate a dataset of 51840 reflectance spectra, representative of the optical diversity of inland water bodies. This simulated dataset was used to develop a retrieval algorithm to determine the dominant phytoplankton group in hyperspectral satellite images. The algorithm is based on a combination of indices that evaluate the position of the green reflectance peak, dependent on the carotenoids' composition, and of a secondary red trough, dependent on phycobiliproteins, chlorophylls -b and -c. The detection thresholds were analyzed as a function of chlorophyll-a concentration, [Chl-a] and its robustness tested against varying concentrations of other optical active constituents of natural waters, namely, Colored Dissolved Organic Matter (CDOM) and suspended Non-Algal Particles (NAP). The algorithm was able to identify the dominance of Cyanobacteria, Chlorophyceae and Brown Algae (Diatoms, Chrisophyceae, Cryptophyceae and brown Dinoflagellates) in the simulated dataset and in a set (N=109) of in situ reflectance data from Spanish lakes and reservoirs. Cyanobacteria got the best classification results, with commission and omission errors of 6.9% and 0%, respectively. These errors were 15.8% and 11.1% when the Brown Algae were the dominant group (>50% of total biomass) and 25.0% and 50.0% for Chlorophyceae. The classification results improved with [Chl-a], with no omission errors for [Chl-a] > 20 mg m-3 for the three taxonomic classes. The algorithm was adapted to the spectral bands of EnMAP and PRISMA and applied to images of these hyperspectral satellites, to obtain thematic maps of dominant phytoplankton classes for several water bodies of the Júcar river basin.

Managing a cascade reservoir system for water supply under extreme drought

Pau Sabater-Liesa[1]*, Juan Carlos García-Pradell[1], Antoni Munné-Torras[2], Carolina Solà-Ortega[2], Jose Javier Rodríguez-Subiza[1]

[1]Ens d'Abastament d'Aigua Ter Llobregat (ATL), Sant Martí de l'Erm,2, 08970 Sant Joan Despí, España. [2]Agència Catalana de l'Aigua (ACA), Carrer de Provença, 260, Eixample, 08008 Barcelona, España

psabater@atl.cat

The reserves of the cascading reservoir system of the Ter River (Sau, Susqueda, and Pasteral), located in northeastern Catalonia, experienced a marked decline between 2021 and 2025 due to a prolonged period of rainfall deficit. From a system storage level of 75% in September 2021, volumes dropped to a minimum of 13% (with only 1% capacity in the Sau reservoir) in March 2024. This reservoir system is one of the main sources of drinking water supply for the city of Barcelona and its metropolitan area. Consequently, the reduction in resource availability and the corresponding deterioration in water quality generated significant social, scientific, and political concerns. An operational management strategy was designed to preserve water quality at the source and to minimize the environmental impacts associated with extreme drought. A weekly monitoring program of physicochemical and biological variables in the water bodies was implemented, revealing a significant increase in nutrients and reduced compound concentrations, probably due to the release of interstitial water from exposed sediments. At the same time, massive cyanobacterial blooms were observed (particularly *Woronichinia* and *Aphanizomenon*). To enhance the system's natural self-purification processes and minimize the occurrence of cyanobacterial blooms, operational rules were dynamically adjusted by modulating extraction flows and selecting the optimal withdrawal depth on a weekly basis. This strategy made it possible to maintain, at all times, a raw water quality compatible with treatment requirements at the drinking water plant, despite the low storage volume and severe water deficit, thus ensuring the continuity of drinking water supply to the population.

Biophysical parameters retrieval from PRISMA and EnMAP satellite for inland water ecological state study

Bárbara Alvado[1], Lissette Sánchez[1], Rebeca Pérez[2], Xavier Sòria-Perpinyà[1], Antonio Ruíz[1], Gabriel Caballero[1], Juan Miguel Soria[2], Eduardo Vicente[2]*, Jesús Delegido[1]

[1]Image Processing Laboratory, Universitat de València, Catedràtic Agustín Escardino Benlloch 9 E4, Paterna, Spain. [2]Cavanilles Institute of Biodiversity & Evolutive Biology, Universitat de València, Catedràtic José Beltrán Martínez 2, Paterna, Spain

Eduardo.Vicente@uv.es

Reservoirs status and water quality, particularly those used for population supply, are a fundamental aspect of European Water Framework Directive (WFD). Anthropogenic pressure and impacts caused by industrial, agricultural, and urban activities can alter their functions, compromising the uses to which they might be subject. Despite not being part of the original formulation of WFD, remote sensing is increasingly being used to assess biophysical variables used in establishing the ecological status of inland waters. The PRISMA and EnMAP satellites are hyperspectral sensors with more than 235 bands and 30 meters spatial resolution, covering both the visible spectrum and the NIR and SWIR range. Through a study that integrates radiometric measurements and the analysis of in situ biophysical variables, it is possible to calibrate and validate algorithms that are subsequently applied to satellite imagery, with the aim of estimate water quality parameters and determine the ecological status of lakes and reservoirs. During 12 field campaigns in Spanish inland waters, samples were taken and radiometric measurements were made. From which all possible band combinations were obtained, correlating them through the best fitting function for 36 water samples. To harmonize the results, a common index was sought for each variable, and the following results were obtained. For Chl-a estimation, the best result is obtained with an NDI between 594 and 693 nm (R2 = 0.90 EnMAP, 0.86 PRISMA). For Secchi disk, the best result is obtained with 692 nm (R2 = 0.97 EnMAP, 0.87 PRISMA). The TSM is estimated by the sum of its organic (SPOM) and inorganic (SPIM) fraction. SPOM is obtained with 714 nm (R2 = 0.97 EnMAP, 0.91 PRISMA) and SPIM with the ratio of 704 and 551 nm (R2 = 0.98 EnMAP, 0.91 PRISMA). Finally, through Chl-a and SDD, the average ecological status of inland water bodies is obtained.

Distance–decay of similarity in zooplankton communities across rice fields of Europe and Asia

Bruno Gabriel Chianese-Blanco[1]*, Javier Armengol-Díaz[1], Alexandre Mestre-Pérez[1], Giampaolo Rossetti[2], Sukonthip Savatenalinton[3], Akeapot Srifa[3], Isara Thanee[3], Francesc Mesquita-Joanes[1], María Antón-Pardo[1]

[1]Institut Cavanilles de Biodiversitat i Biologia Evolutiva (ICBiBE) – Universitat de València, 46980, Paterna, Spain
[2]University of Parma, 43121, Parma, Italy 3 Mahasarakham University, 44150, Maha Sarakham, Thailand

bruga@uv.es

The pattern of distance-decay of similarity in ecology describes the negative relationship between community similarity and spatial distance. It is driven by increasing environmental heterogeneity (environmental filtering or niche-based processes) and by spatial processes such as dispersal limitation. Since its introduction as a conceptual framework in biogeography, numerous studies have yielded valuable insights. However, few studies have attempted to minimise environmental heterogeneity in order to isolate spatial effects on the distance-decay relationship. To address this issue, we selected rice fields as a model habitat, an anthropogenic ecosystem with an almost global distribution and relative environmental homogeneity compared to most natural habitats. We surveyed 60 rice fields across Spain, Italy, and Thailand (20 per country) following a hierarchical sampling design of spatial distances spanning 0.1 km (close rice fields), 10 km (rice fields in the same region), 100 km (rice fields in the same country), 1000 km (rice fields in the same continent), and 10000 km (comparing Europe and Asia). Zooplankton samples (Rotifera, Cladocera, and Copepoda) were collected from each rice field, and abundances of each species were estimated under the microscope. Distance- decay of similarity was estimated as the relationship between the Jaccard similarity index and the log-transformed spatial distance between sites. Our results indicate a negative and significant slope for this relationship. When comparing the slopes obtained for each spatial scale, no pairwise differences at lower spatial scales (0.1 to 1000 km) were found, but the largest spatial scale slope was steeper than those at country and continental scales. These results suggest that the effects of spatial scale on zooplankton community similarity are most evident at large spatial scales, due to strong biogeographic barriers, while in close rice fields other processes may be operating, such as anthropogenic impacts or ecological drift.

Biomonitoring of island freshwater ecosystems: the effect of island biogeography on the performance of biological indices

Anastasia Lampou[1,2,3]*, Ioannis Karaouzas[3], Nikolaos Skoulikidis[3], Núria Bonada[1,2]

[1]FEHM-Lab (Freshwater Ecology, Hydrology and Management), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Catalonia, Spain. [2]Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona (UB), Diagonal 643, 08028 Barcelona, Catalonia, Spain. [3]Institute of Marine Biological Resources & Inland Waters, Hellenic Centre of Marine Research (HCMR), Greece

alampou@hcmr.gr

Biological quality indices developed under the Water Framework Directive aim to detect ecological degradation driven by anthropogenic pressures. However, in insular systems, natural biogeographical constraints may influence macroinvertebrate assemblages independently of disturbance. Observations from Aegean island streams indicated that the Hellenic Evaluation System 2 (HESY2) benthic index frequently classified sites as being degraded despite limited anthropogenic pressures. This pattern raised the hypothesis that part of the apparent degradation may reflect island biogeography rather than true ecological impairment. To explore this hypothesis, 142 river sites across 15 Aegean islands were analysed. A pressure-based expectation of ecological quality was defined using an updated 27-criteria version of the Mediterranean Reference Criteria (MRC), encompassing land-use intensity, point and diffuse pollution sources, hydromorphological alterations, and flow regulation pressures. The number of criteria fulfilled at each site was used as a continuous variable representing the degree of conservation/anthropogenic pressure and anchored at reference conditions (EQR=1 when MRC=27). Deviations from this pressure–response expectation were calculated and examined in relation to island area and distance to the nearest mainland (Greece or Turkey). Deviation from the pressure-based expectation was strongly associated with island area (R^2=0.416, $p < 0.001$), with smaller islands consistently showing lower HESY2 values than expected from anthropogenic pressure alone. Distance to mainland was not significant in a linear form. These findings suggest that reduced family richness in smaller islands may reflect species-area constraints rather than ecological degradation. Assessment frameworks that do not account for biogeographical structure may therefore underestimate ecological status in Mediterranean island systems. Our results highlight the need to adapt or develop biomonitoring methods specifically tailored to island freshwater ecosystems to avoid biased ecological assessments.

Macrophyte and zooplankton propagule dispersal by anuran tadpoles in temporary ponds

Adrián Monreal*, Carmen Díaz-Paniagua, Ivan Gomez-Mestre

Dept. of Ecology and Evolution, Doñana Biological Station, Seville E41092, Spain

adrian.monreal@ebd.csic.es

Macrophyte and zooplankton dispersal depends on their propagules, that rely on wind and zoochory to reach other waterbodies. However, dispersal within a water body is also important, especially in the case of macrophytes, as it may allow them to reach favorable microhabitats. These movements are possible by buoyancy or by being transported by animals such as aquatic birds or fishes. In previous work, we found that anuran tadpoles were able to ingest and disperse viable macrophyte propagules. Anuran tadpoles are commonly found in temporary ponds, where they can reach high densities and be the most abundant vertebrates. They can also be very motile within ponds and they have usually diverse diets, feeding on detritus and macrophytes, for instance. We wanted to explore the role of tadpoles as dispersers of propagules of aquatic organisms in temporary ponds. For that, we sampled monthly five temporary ponds located inside Doñana National Park during the whole flooding period, from December 2024 to July 2025. We sampled tadpoles of six different anuran species. The tadpoles were placed in plastic cups for 24 h, then the fecal samples were collected and dried and the tadpoles released. Feces were inspected under a stereomicroscope to search for any macrophyte or zooplankton propagule. We performed germination trials of the macrophyte propagules recovered. Preliminary results show that all the tadpole species studied were able to disperse zooplankton propagules, while seeds (of at least 9 species) were found in the samples from the bigger tadpole species, such as *Pelobates cultripes* and *Pelodytes ibericus*. The abundance of both types of propagules was also higher in the samples from the bigger tadpole species and many seeds were able to germinate. All of this highlights the importance of tadpoles as primary propagule dispersers in temporary ponds, which has been overlooked.

How to evaluate functional diversity responses to anthropogenic disturbance at multiple scales in streams in the Cerrado?

Pedro Amaral[1]*, Luana Caiafa[2], Ricardo Solar[2], Marcos Callisto[1]

[1]Universidade Federal de Minas Gerais, Instituto de Ciências Biológicas, Departamento de Genética, Ecologia e Evolução, Laboratório de Ecologia de Bentos, Avenida Antônio Carlos, 6627, CP. 486, CEP 31270-901, Pampulha, Belo Horizonte, MG, Brazil. [2]Universidade Federal de Minas Gerais, Instituto de Ciências Biológicas, Departamento de Genética, Ecologia e Evolução, Centro de Síntese Ecológica e Conservação, Avenida Antônio Carlos, 6627, CP. 486, CEP 31270-901, Pampulha, Belo Horizonte, MG, Brazil

pedrobio2009@gmail.com

Functional diversity (FD) responds to environmental disturbances, but it remains unclear which FD indices are most sensitive to detecting effects across disturbance gradients in aquatic insect assemblages. Our objective was to evaluate the sensitivity of nine FD indices across a gradient of anthropogenic disturbance and at three spatial scales: microhabitat (fine sediment cover, PCT_FN), riparian area (Local Disturbance Index, LDI), and watershed (Watershed Disturbance Index, CDI). A total of 24,577 aquatic insects were sampled in 153 streams distributed across five hydrological units of hydroelectric developments in the Brazilian Cerrado. Functional characteristics were compiled from previous studies in the Neotropical region and included morphological, trophic, behavioral, and life history aspects. Predictor variables were selected using a RandomForest-based feature selection algorithm, and mixed models (GAMM/GLMM) were fitted to assess the influence of disturbance gradients. The results identified that basin-scale disturbance (CDI) was the most determining factor for changes in the functional structure of the assemblages. The increase in CDI was associated with reductions in functional dispersion, functional divergence, functional specialization, and mean functional distance in pairs, indicating functional homogenization and lower specialization. In contrast, functional originality increased with increased environmental disturbance. Disturbance at the microhabitat scale (PCT_FN) had specific effects on functional divergence and functional equitability, whereas disturbance at the local scale (LDI) did not affect functional diversity metrics. Overall, functional diversity responses depended on both spatial scale and the ecological dimension represented by each index, underscoring that interpretations of disturbance effects in stream communities require combining metrics that reflect different components of functional structure.

Using cross-taxon ecological uniqueness for conservation prioritization of Mediterranean ponds

Carlos Antonio Cuenya Duarte[1]*, Francisco García-Criado[1], Eloy Bécares[1,2], Saúl Blanco[1,2], María Borrego-Ramos[2], Camino Fernández-Aláez[1], Alejandro Nistal-García[1,2], Jorge García Girón[1,2,3]

[1]Department of Biodiversity and Environmental Management, Universidad de León, Campus de Vegazana, 24007 León, Spain. [2]Institute for the Environment, Universidad de León, Calle La Serna 58, 24007 León, Spain. [3]Geography Research Unit, University of Oulu, P.O. Box 8000, Oulu, Finland

ccuend00@estudiantes.unileon.es

Las lagunas mediterráneas, caracterizadas por hidroperiodos oscilantes y dinámicas ecológicas únicas, a menudo quedan fuera del marco de actuación durante la ejecución de planes de gestión y conservación de los ecosistemas dulceacuícolas. Precisamente por estas particularidades es menester la puesta en marcha de nuevas métricas y herramientas numéricas enfocadas a la identificación de ambientes singulares para su conservación. En el presente estudio se plantea el concepto de "singularidad ecológica" (ecological uniqueness) como índice diagnóstico de las prioridades de conservación en matrices espaciales discontinuas, enfocado en el análisis de múltiples grupos biológicos acuáticos, incluyendo tanto a productores primarios basales (algas bénticas y macrófitos) como a consumidores de diferentes eslabones tróficos (zooplancton, macroinvertebrados y anfibios). Entender cómo se relacionan los patrones de singularidad de las comunidades de diversos grupos biológicos, así como con las características ambientales de su medio circundante, puede permitir el diseño eficiente de diferentes rutas y estrategias de conservación en redes lagunares regionales, mejorando a su vez la administración de recursos humanos, logísticos y económicos. Mediterranean ponds, characterized by oscillating hydroperiods and unique ecological dynamics, are frequently overlooked when it comes to the implementation of management and conservation planning of inland waters. As a result, developing novel metrics and statistical approaches to pinpoint sites exhibiting elevated ecological uniqueness remains a fundamental endeavour for their effective conservation. This study uses the ecological uniqueness approach to guide conservation prioritization of Mediterranean ponds, drawing on a multi-taxon analysis encompassing basal primary producers (benthic algae and macrophytes) alongside consumers spanning diverse trophic levels (zooplankton, macroinvertebrates, and amphibians). We posit that elucidating the interrelationships among ecological uniqueness patterns of multiple organismal groups, as well as their modulation by site-specific environmental features, will enable the formulation of efficient, regionally tailored conservation strategies for pond networks, whilst optimizing the allocation of human, logistical, and economic resources.

Linking β-diversity and demography to inform conservation priorities in Andean and coastal river networks of Chile

Konrad Górski[1,2]*, Rodrigo Ramírez-Álvarez[2], Javier Vera[1], Nicole Colin[3], Evelyn Habit[4,5]

[1]Instituto de Ciencias Marinas y Limnológicas, Facultad de Ciencias, Universidad Austral de Chile, Valdivia, Chile. [2]Facultad de Ciencias, Universidad Católica de la Santísima Concepción, Concepción, Chile. [3]Instituto de Ciencias Ambientales y Evolutivas, Facultad de Ciencias, Universidad Austral de Chile, Valdivia, 5090000, Chile. [4]Departamento de Sistemas Acuáticos, Facultad de Ciencias Ambientales, Universidad de Concepción, Concepción, Chile. [5]Centro EULA-Chile, Universidad de Concepción, Concepción, Chile

Konrad.Gorski@uach.cl

To inform large-scale conservation strategies for riverine fishes, assemblage-level patterns should be evaluated alongside demographic and reproductive variation to identify where recruitment and persistence are concentrated across river networks. Chilean rivers are organised as parallel basins running North–South and include two types: large Andean basins and smaller Coastal basins. How fish populations and assemblages are structured across these contrasting river network types remains poorly understood, yet it is essential for conservation planning at landscape scales. Using standardized bimonthly surveys over one year (30 sites across 3 Andean and 4 Coastal river basins), we integrated (i) community-level β-diversity analyses (incidence-based Jaccard and abundance-based Bray–Curtis; turnover vs. nestedness) with (ii) demographic and reproductive metrics for two model native fishes: facultatively amphidromous *Galaxias maculatus* and freshwater resident *Percilia gillissi*. At the assemblage level, Andean and Coastal rivers exhibited strong compositional contrasts. Between-river dissimilarity was largely explained by species turnover with low nestedness, indicating basin-specific structuring rather than simple richness gradients. Within rivers, community composition remained comparatively stable through the annual cycle, suggesting limited seasonal reshuffling at the assemblage scale. At the population level, *G. maculatus* was widespread, with higher abundances and more complex size structures in Andean basins, whereas Coastal rivers were dominated by juveniles—patterns consistent with reach-specific recruitment zones and a potential role of Coastal habitats in amphidromous recruitment. *Percilia gillissi* displayed a more restricted distribution, with abundances declining southward and an absence from upper and estuarine reaches. Both species concentrated reproductive activity in austral spring and summer, with basin-specific differences in synchrony and ontogenetic zonation linked to flow and habitat gradients. Together, these integrative patterns link turnover-driven regional assemblage structuring with basin-dependent recruitment strategies, underscoring protection of hydrological connectivity and productive reaches as priorities for conserving native fish diversity and sustaining recruitment across contrasting river network types.

Refuges modulate selection pressures on Atlantic salmon juveniles during drought

Eva Haristoy[1,2]*, Arturo Elosegi[2], Matthieu Lingrand[1], Aurélie Manicki[1], Cédric Tentelier[1]

[1]Universite de Pau et des Pays de l'Adour, E2S UPPA, INRAE, ECOBIOP, 173 route de Saint-Jean-de-Luz, 64310, Saint-Pée-sur-Nivelle, France; [2]Department of Plant Biology and Ecology, Faculty of Science and Technology, University of the Basque Country EHU, Leioa, Spain

eva.haristoy@inrae.fr

Freshwater ecosystems are particularly sensitive to climate change. During drought periods, water flow can decrease drastically, leading to altered abiotic parameters and a reduction of available habitats. Fish populations, especially those sensitive to such disturbances, face a significant adaptive challenge, and drought may select for particular phenotypes or genotypes. However, some habitats act as refuges that enable individuals to resist and survive during drought. These refuges may either be equally beneficial to any individual in the population or act selectively in two different ways: On the one hand, by exposing individuals to less drastic environmental conditions, refuge use may dampen the natural selection imposed by drought (Behavioural Inertia). On the other hand, by exposing individuals to novel environmental conditions, refuge use may steepen selection on traits that are advantageous in these conditions (Behavioural Drive). This study investigates whether summer drought selectively reduces the fitness of juvenile Atlantic salmon (*Salmo salar*) on a pleiotropic major life-history gene (Vgll3) and fish physical condition, and whether the presence of refuges modulates this selection. To test these hypotheses, we conducted a one-month drought experiment in a semi-controlled setting using two factors with two levels each: flow (20 or 2 $L \cdot s^{-1}$) and refuge (presence or absence), and juvenile salmon from 7 families presenting polymorphism in mass, fork length and Vgll3 genotype. We found that refuges significantly modulated selection pressure on fish physical condition during drought, with better survival associated to smaller individuals in the absence of refuge, and better survival associated with larger individuals in the presence of refuges. We found no impact of either drought or refuge on the selection on the Vgll3 gene. By inversing the selection pressure acting on fish size, drought and refuge use may impact the evolution of life history in salmon, although not through changes in the Vgll3 gene.

Using RFID technology to monitor elusive semi-aquatic mammals: insights from the Pyrenean desman

Jon Levy-Otheguy[1,2]*, Lander Olasagasti[1], Miren Aldasoro[1], Nerea Vallejo[1], Jorge González- Esteban[3], Frank D'Amico[2], Joxerra Aihartza[1]

[1]Department of Zoology and Animal Cell Biology, Faculty of Science and Technology, University of the Basque Country (EHU), Leioa, The Basque Country, Spain. [2]CNRS/Univ Pau & Pays Adour, Laboratoire de Mathématiques et de leurs Applications de Pau (LMAP), UMR 5142, 64600 Anglet, France. [3]DESMA Estudios Ambientales, Ituren, Navarre, Spain

jon.levyotheguy@orange.fr

Understanding movements, activity patterns, and population processes of elusive small mammals remains challenging, particularly in aquatic and semi-aquatic systems where detection is imperfect, and monitoring is often invasive or temporally limited. We evaluated the use of Radio Frequency Identification (RFID) technology as a non-invasive and long-term monitoring tool for such species, using the Pyrenean desman (*Galemys pyrenaicus*) as a model organism. We tested three main hypotheses: (1) RFID barrier antennas provide reliable detections without repeated physical recapture, (2) detection probability varies with environmental conditions, especially hydrological variability, and (3) coupling RFID systems with artificial latrines improves detection and enables discrimination between marked and unmarked individuals. A limited number of individuals were equipped with PIT tags and monitored using RFID barrier antennas deployed across river channels. Radio telemetry was used to assess detection performance and validate RFID detections. Monitoring was conducted over several months, and detection data were analysed using exploratory multivariate approaches and generalized linear models. RFID monitoring yielded high and consistent detection rates and allowed continuous individual tracking beyond the operational limits of conventional VHF telemetry. Detection probability varied among antenna locations, emphasizing the influence of local physical and hydraulic conditions at deployment sites. River discharge strongly affected detectability, with peak detection occurring at intermediate flow levels, whereas movement direction (upstream vs. downstream) had a weaker effect. RFID-equipped artificial latrines proved effective for linking indirect signs of presence (scat deposition) to visits by identified individuals, while also revealing activity by unmarked animals. Overall, RFID technology provides a robust and transferable framework for monitoring elusive small mammals in linear aquatic habitats. When combined with complementary devices such as artificial latrines, RFID systems offer strong potential for individual-based monitoring and the application of mark–recapture approaches in challenging field conditions.

A comparison of methods for potential Species Distribution Models of aquatic insects in the Iberian Peninsula

Carlota Sánchez-Campaña[1,2]*, Núria Bonada[1,2], David Sánchez-Feránandez[3], Emilio García- Roselló[4], Raúl Acosta[1,5], Martiño Cabana[6], Tommaso Cancellario[7], Adolfo Cordero-Rivera[8], Jesús M. Evangelio Pinach[9], Marcos González[10], Manuel Jesús López-Rodríguez[11], Cecilia Díaz-Martínez[12], Jesús Martínez[13], Saray Mañas-Jordá[3], Xavier Maynou[14], Andrés Millán[3], Florent Prunier[15], José Manuel Tierno de Figueroa[16], Jorge M. Lobo[17]

[1]FEHM-Lab (Freshwater Ecology, Hydrology and Management), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Universitat de Barcelona, Barcelona, Spain. [2]Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona, Barcelona, Spain. [3]Department of Ecology and Hydrology, University of Murcia, Murcia, Spain. [4]Department of Computer Science, University of Vigo, Vigo, Spain. [5]Institute of Environmental Assessment and Water Research (IDAEA-CSIC), Barcelona, Spain. [6]Grupo de Investigación en Bioloxía Evolutiva (GIBE), Departamento de Bioloxía, Facultade de Ciencias, Universidade da Coruña, A Coruña, Spain. [7]Centre Balear de Biodiversitat, Universitat de les Illes Balears, Palma, Spain. [8]Universidade de Vigo, ECOEVO Lab, Escola de Enxeñaría Forestal, Campus A Xunqueira, 36005 Pontevedra, Galiza, Spain. [9]Museu Valencià d'Història Natural–i\Biotaxa, Hort de Feliu–Alginet, Apdo. 8460, E–46018 Valencia, Spain. [10]Department of Zoology, Genetics and Physical Anthropology, University of Santiago de Compostela, Santiago de Compostela, Spain, Santiago de Compostela, Spain. [11]Department of Ecology, University of Granada, Granada, Spain. [12]Museo Nacional de Ciencias Naturales, MNCN-CSIC, José Gutiérrez Abascal 2, 28006 Madrid, Spain. [13]Department of Environmental Sciences, University of Castilla-La Mancha, Toledo, Spain. [14]Department of Evolutionary Biology, Ecology and Environmental Sciences, University of Barcelona, Avda. Diagonal 643, 08028, Barcelona, Catalonia, Spain. [15]AEA El Bosque Animado, Valle del Genal, Spain. [16]Department of Zoology, University of Granada, Granada, Spain. [17]Department of Biogeography and Global Change, National Museum of Natural Sciences (MNCN CSIC), Madrid, Spain.

sanchezcc@ub.edu

Robust knowledge of species' geographic distributions is a cornerstone for biodiversity conservation, particularly in regions where exceptional diversity coincides with intense anthropogenic pressure. The Mediterranean Basin, one of the world's biodiversity hotspots, exemplifies this, as its freshwater ecosystems are increasingly degraded by multiple human- driven stressors. Aquatic insects are central to ecosystem functioning and reach remarkable diversity in the Iberian Peninsula (IP). However, their distribution remains insufficiently characterized, limiting the identification of priority areas and the implementation of evidence- based conservation strategies. In this context, Species Distribution Models (SDMs) emerge as a powerful shortcut to infer biodiversity distribution patterns from incomplete occurrence data. Here, the SDM which provided the best fit for Iberian Coleoptera, Odonata, Plecoptera and Trichoptera was evaluated. Using the ModestR software, two modeling approaches were compared, MaxEnt and Niche of Occurrence (NOO), across two spatial extents: covering all IP and restriction to the basin adjacent to each occurrence record. Inventory completeness was used to improve model validation (i.e., absence in a grid cell was considered reliable when inventory completeness was high and no species record within that cell). Models were calculated at a 5- minute resolution; species with ≤10 records were not considered. SDMs that maximized sensitivity and specificity were considered optimal. Results show that model performance varied even among congeneric species. Regarding SDM performances, MaxEnt projected across all IP was optimal for 29%

of the species, whereas MaxEnt with restricted distribution performed better for 2%. For NOO, 1% of the species were better explained using restricted distribution, while for 68% the best-performing model was NOO projected across all IP. For 48% of the species, two or more SDM were equally optimal. These findings underscore the need for species-specific modelling strategies when predicting distributions, demonstrating that, under certain conditions, relatively simple modelling approaches can achieve robust and reliable predictive performance.

Amphibian populations in Portuguese streams across an urbanisation gradient

Gabriel T. Silva[1]*, Ana R. Calapez[1], José M. Oliveira[1], Cheyenne Vigileos[1], Fernanda Rodrigues[1,2,3], Marcos Dias[1], Pieter Linden[1], Maria J. Feio[1]

[1]University of Coimbra, MARE/ARNET, Department of Life Sciences, Largo Marquês de Pombal, Coimbra 3004-517, Portugal. [2]University of Coimbra, CERES, Department of Chemical Engineering, Rua Sílvio Lima, Coimbra 3030-790, Portugal. [3]University of Coimbra, INESC Coimbra, Department of Civil Engineering, Rua Luis Reis Santos, Coimbra 3030-788, Portugal

g.t.silvapiranhaseco@gmail.com

Urban areas are expanding and the associated pressures are driving significant declines in amphibian populations. Amphibians serve as environmental quality bioindicators, offering early warnings of contamination due to their physiological sensitivity. Urban streams can act as refugia by providing water and functioning as ecological corridors, yet they are increasingly subjected to multiple stressors. Although recent studies have explored the impacts of urban pressures on amphibians, the effects on community structure within stream habitats remain poorly understood. This study aims to understand how varying levels of urbanization influence local amphibian communities in urban streams by comparing diversity and functional traits along an urban gradient. We conducted 3 seasonal surveys, sampling larvae and adults and characterizing environmental variables across 20 streams in Central Portugal, which were previously classified according to an urbanization gradient. We assessed richness, composition, abundance, breeding distribution and biological traits. A total of 11 species were recorded, among which three endemic species are classified under conservation statuses of concern. A clear segregation in community composition was identified. The most vulnerable species exhibit restricted ecological niches, associated with well-oxygenated streams and a better morphological condition, unlike generalists, which demonstrate greater plasticity, tolerating urbanisation. Trait-based analysis reveals a functionally redundant community, with high evenness and reduced competition. Regarding body size, *P. perezi*, a more generalist species, increased with higher imperviousness. In contrast, the *Lissotriton boscai* complex exhibited fluctuating patterns, while *S. salamandra* showed lower sizes in the most disturbed sites. This study contributes to understanding the complexity of amphibian population dynamics and their responses to urban stress, highlighting that the resilience and survival of sensitive species may be compromised in unstable habitats.

Diversidad y distribución de grandes branquiópodos de lagunas temporales de la Bahía de Cádiz

Carlos Vázquez-Chanivet*, Ismael Díaz Ramírez, Juan García-de-Lomas, Carmen Díaz Paniagua, Margarita Florencio

Estación Biológica de Doñana, 41092, Sevilla, España

carlos.vazquez@ebd.csic.es

Los grandes branquiópodos son organismos clave en el funcionamiento de las lagunas temporales, ya que son habitantes casi exclusivos de este tipo de medios. Esto cobra especial importancia en España, donde sus hábitats esenciales son las lagunas temporales mediterráneas. A pesar de que estas lagunas son Habitats Prioritarios para la conservación por la Directiva Hábitat de la UE (código 3170), su degradación y destrucción en los últimos años está llevando a la desaparición de estos organismos. La conservación de estos hábitats y su biodiversidad es esencial en el contexto de Cambio Global, donde las tendencias climáticas y los efectos antrópicos comprometen la existencia de estos ecosistemas. Por ejemplo, es llamativo el caso de la "Gambilusa" *Linderiella baetica* (Alonso & García de Lomas, 2009), especie que se ha incluido recientemente en el Catálogo Español de Especies Amenazadas bajo la categoriía "en Peligro de Extinción". Para contribuir a la conservación de la biodiversidad de estos hábitats, en este trabajo describimos la riqueza de especies de grandes branquiópodos de 29 lagunas temporales de la Bahía de Cádiz, alrededor de la localidad tipo de *L. baetica*. En total, se encontraron 7 especies en un área de distribución de unos 40 km^2 en diferentes contextos ecológicos. Los resultados obtenidos tras analizar las muestras y el sedimento nos permitirán evaluar la estructura y composición del banco de propágulos y detectar la posible presencia de *L. baetica*. Adicionalmente, se llevarán a cabo experimentos bajo condiciones controladas en cámaras climáticas para estudiar los requerimientos necesarios y abordar la posible recuperación de esta especie endémica. Este contexto nos permitirá reportar la presencia y preferencias ecológicas de los grandes branquiópodos del entorno de la bahía de Cádiz y gestionar este enclave como un área de especial interés para la conservación de estos organismos y sus hábitats.

Plankton biodiversity of permanent and temporary high-altitude Mediterranean ponds of Djurdjura Massif (NE Algeria)

Lidia Baitiche[1,2]*, Mohammed Mebarki[2], Manuel E. Muñoz-Colmenares[3], Eduardo Vicente[3], Juan M. Soria[3]

[1]Laboratory of Limnology, Department of Microbiology and Ecology, Faculty of Biological Sciences, Universitat de València, 46980, Paterna, València, Spain. [2]Laboratory of Dynamics and Biodiversity (LADYBIO), FSB, University of Science and Technology Houari Boumediene USTHB, LP 32 El-Alia, Bab Ezzouar, Algiers, Algeria. [3]Cavanilles Institute of Biodiversity and Evolutionary Biology (ICBiBE), Universitat de València, 46980, Paterna, València, Spain.

baitiche.lid@gmail.com

High-altitude Mediterranean ponds of Djurdjura Massif represent unique and fragile freshwater ecosystems and act as sensitive sentinels of climate change, yet they remain poorly documented in North Africa. These small lentic ecosystems are primarily sustained by precipitation and snowmelt and are characterized by a strongly seasonal hydroperiod, with alternating flooded, dry, and, at higher elevations, frozen phases under a sub-humid Mediterranean climate. Despite their limited spatial extent, they support specialized biological communities adapted to pronounced environmental variability. This study investigates plankton biodiversity and ecological functioning in six permanent and temporary high-altitude ponds located between 790 and 1700 m a.s.l. Seasonal sampling was conducted at three stations per water body, selected based on the presence of aquatic vegetation and proximity to inflows, and covered both pelagic and benthic zones using standardized limnological protocols. Plankton community composition, diversity, and abundance were analyzed to assess ecosystem structure and trophic conditions. Preliminary results show that phytoplankton assemblages comprised 135 taxa and were dominated by Chlorophyceae (40%) and Bacillariophyceae (37%), while Cyanophyceae were weakly represented (6%), indicating generally balanced trophic conditions. Zooplankton communities exhibited high taxonomic richness, with 57 taxa identified across Rotifera, Copepoda, Cladocera, and Ostracoda. Rotifers were numerically dominant (60%), followed by copepods (19%), cladocerans (15%), and ostracods (6%). Permanent lakes supported relatively stable plankton assemblages, whereas temporary ponds showed pronounced seasonal variability linked to hydroperiod fluctuations. The coexistence of cold-adapted, eurytopic, and Mediterranean taxa highlights the combined influence of altitude, climatic seasonality, and hydrological regime on community structuring, as well as the persistence of resistant species adapted to extreme and fluctuating environmental conditions. These findings emphasize the high conservation value of Djurdjura mountain ponds as reservoirs of plankton biodiversity and natural laboratories for studying climate-driven ecological change. The study provides essential baseline data for long-term monitoring of plankton diversity and ecology and supports the integration of plankton-based indicators into conservation and management strategies for vulnerable high- altitude freshwater ecosystems.

Insects as bioindicators of reference conditions in neotropical protected headwater streams

Marcos Callisto

Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, Avenida Antonio Carlos 6627, Belo Horizonte, MG, Brasil

mcallisto13@gmail.com

Often, protected areas preserve the best water-quality conditions in headwater streams, which may serve as reference conditions for biomonitoring assessment studies. Under reference conditions, it is expected to find greater physical habitat diversity, good water quality, natural flow, and absence of (or at least minimal) human disturbance, which favor high taxonomic and functional diversity of aquatic insects. No native or invasive species are expected to be absent; food and detritus chains link in-water, riparian metaecosystems, and terrestrial inputs, as a consequence of expected higher natural cover upstream of the headwater. Comparing different Brazilian biomes, latitudinal and elevational gradients, and vegetation fitofisionomies may influence the taxonomic richness and abundance of aquatic insects, while temperature may limit Plecoptera in low-latitude streams in Amazonia and favour stenotermic species in South America or high-altitude waters in the Campos Rupestres. Although Ephemeroptera, Plecoptera, and Trichoptera have high species richness and are expected to be abundant in headwater streams, other aquatic insects are also present, often at similarly high abundances but not dominant. Investigating reference conditions and the taxonomic, functional, and genetic diversity of bioindicators of reference conditions in headwaters is a key knowledge gap in Brazil.

Diatom diversity in tropical mountain rivers of the Colombian Caribbean

María Camila Labrada, John Donato-Rondón*

Universidad Nacional de Colombia, Sede Bogotá, Facultad de Ciencias, Departamento de Biología, Av (Cra) 30 No.45-03, Bogotá, 111321, Colombia.

jcdonator@unal.edu.co

The rivers of the Colombian Caribbean constitute strategic systems for maintaining biodiversity and ecological connectivity, and their biological communities are key elements for understanding environmental quality and river processes. Among benthic algae, diatoms stand out as sensitive bioindicators of global changes and biological diversity. We here evaluated the composition and diversity of diatom assemblages in the Guatapurí and Cesar rivers, analyzed their relationship with environmental variables, and interpreted the structure and patterns based on the autoecology of the dominant species. Fifty points were sampled for each river in 50-meter stretches, where diatoms were collected, and physical and chemical parameters of the water were measured. Species diversity indices were calculated, and Principal Component Analysis (PCA) and Canonical Correspondence Analysis (CCA) were used to organize the biological and environmental data. Thirty-two morphospecies were recorded, with the Cesar River recording the greatest species richness (24 spp.), in contrast to the Guatapurí River (19 spp.). The dissimilarity in species composition and relative abundances between the two systems was high. PCA showed a marked separation between the rivers reflecting physical and chemical variations. At the same time, the CCA defined a differential pattern associated with gradients of conductivity, alkalinity, and dissolved oxygen. These variables structured the diatom community of the river systems studied. A Non-Metric Multidimensional Scaling (NMDS) showed that the assemblages composition was largely determined by ecological and environmental preferences. Taken together, these results show the value of diatoms for interpreting environmental gradients and provide insights into the algal flora of the Colombian Caribbean.

Multi-decadal trajectories and temporal stability of lake macrophyte communities: a cross-continental comparison

Julie Crabot[1]*, Michael Tseitlin[2], Janne Alahuhta[2], Xiaoming Jiang[2], Danella Larson[3], Jorge García-Girón[1,2]

[1]Department of Biodiversity and Environmental Management, University of León, Campus de Vegazana, 24007 León, Spain. [2]Geography Research Unit, University of Oulu, Oulu, Finland. [3]United States Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA

jcra@unileon.es

Freshwater ecosystems are undergoing rapid transformations under increasing anthropogenic pressures, yet our ability to compare ecological change across broad spatial and temporal scales remains limited. Aquatic macrophytes are widely used as indicators of ecological status, particularly in European monitoring frameworks such as the Water Framework Directive, but macro-scale assessments of their long-term biogeographical patterns and temporal stability are still scarce. Here we compile more than two decades of macrophyte survey data from hundreds of lakes across northern Europe and North America to investigate large-scale temporal dynamics in freshwater plant communities. Using long-term presence–absence records, we quantify community change through a suite of temporal metrics, including compositional turnover, community trajectories, and measures of temporal stability. We further explore how both local environmental conditions (e.g., nutrient concentrations, conductivity) and broad-scale climatic gradients relate to observed patterns of community dynamics. By integrating long-term monitoring data across continents, this study aims to provide a comparative perspective on the temporal behavior of freshwater macrophyte communities. The results will help clarify whether lake plant communities exhibit consistent trajectories or stable states across regions, and how environmental drivers shape these dynamics. Such insights are essential for understanding biodiversity responses to global change and for informing future freshwater management and restoration strategies.

Food-web structure across dendritic networks: spatial organisation, environmental and fragmentation effects

Iñaki Fernández de Larrea[1]*, Ioar De Guzmán[1,2], Mario Brauns[3], José M. González[4], Arturo Elosegi[1], Maite Arroita[1], Aitor Larrañaga[1]

[1]Departamento de Biología Vegetal y Ecología, Universidad del País Vasco/Euskal Herriko Unibertsitatea. Leioa, Bizkaia. [2]Ecologie Comportementale Et Biologie Des Populations de Poissons (UMR Ecobiop), French National Research Institute for Agriculture, Food and Environment (INRAE), Saint-Pée Sur Nivelle, France. [3]Department of River Ecology, Helmholtz Centre for Environmental Research-UFZ, Magdeburg, Germany. [4]Escuela Superior de Ciencia Experimentales y Tecnología, Universidad Rey Juan Carlos, Móstoles (Madrid).

inaki.fernandezdelarrea@ehu.eus

Food webs describe networks of trophic interactions that link community composition with the flow of energy and matter, thus connecting ecosystem structure with functioning. In river ecosystems, food webs are highly complex due to the dendritic configuration of river networks, pronounced environmental gradients, and frequent disruptions of hydrological connectivity, especially in headwater streams. In these systems, basal resources are typically dominated by terrestrial detritus (allochthonous inputs), although benthic biofilm (autochthonous production) also represents a key food source. The quantity and quality of these resources vary widely among catchments and stream reaches, and such variation—together with environmental fluctuation and hydrological fragmentation—can shape trophic pathways and the isotopic signatures of food webs. Stable isotope analyses ($\delta^{13}C$ and $\delta^{15}N$) are widely used to characterize food-web structure because they integrate assimilated diet over time. However, comparisons across sites are often constrained by spatial variability in isotopic baselines. To address this, we investigated the isotopic structure of food webs across five headwater river networks in the Basque Country and Navarre. At 50 sites, we sampled six nodes of the aquatic food webs: basal resources (i.e. biofilm and detritus), macroinvertebrates (primary consumers, omnivores, carnivores), and fishes. We hypothesized that (i) the largest isotopic differences would occur among river networks; (ii) variation in $\delta^{13}C$ and $\delta^{15}N$ metrics would be primarily explained by environmental gradients; and (iii) hydrological fragmentation would enhance isotopic differentiation among sites. As expected, isotopic variability was greatest among river networks, followed by among-site differences, supporting a hierarchical spatial structure. Environmental gradients—particularly conductivity, land cover, and habitat heterogeneity—explained isotopic dissimilarities more strongly than geographic distance. Contrary to our expectations, fragmentation did not increase isotopic distances among sites. Overall, our results highlight environmental filtering, rather than hydrological fragmentation, as the dominant driver of isotopic organization in riverine food webs.

Relative contributions of local and regional drivers to macroinvertebrate community structure in the Ebro River basin

José María Fernández-Calero[1]*, Elvira Romans[1], David Cunillera-Montcusí[2], Alejandra Jiménez[1], Lara Sánchez[1] , Montserrat Real[1]

[1]Departamento de Medio Ambiente y Sostenibilidad. Área de Ecología Acuática. AECOM SPAIN DCS S.L. Calle Casp, 108. 08010. Barcelona, España. [2]IFREMER–DYNECO/LEBCO, Centre de Bretagne. France.

josemafc.46@gmail.com

Freshwater macroinvertebrate communities are shaped by a combination of local factors shaped by environmental conditions (e.g., habitat heterogeneity, hydrogeomorphology, physicochemical characteristics) and regional factors derived from dispersal and connectivity. While metacommunity theory explicitly integrates these multi-scale factors, the ecological assessment developed by the Water Framework Directive (WFD) focuses primarily on local factors and disregards regional ones, which are only considered by waterbody typology and the analysis of pressures at the sub-catchment scale. In this study, we assess the relative contribution of local and regional drivers to macroinvertebrate community structure in the Ebro River basin, a large and environmentally heterogeneous system characterized by pronounced climatic, hydrological, altitudinal, land-use, and anthropogenic gradients. Our aim is to capture how regional hydrological conditions may modulate dispersal dynamics. Thus, we analyse two representative years classified through the Standard Precipitation Index (SPI): a dry year and a wet year. We considered local physicochemical variables and regional descriptors (euclidean, topographic, and network distances) along with connectivity metrics to quantify how much they contribute to explain community composition. Furthermore, we assess the relevance of these regional factors on shaping widely used biological indices such as IBMWP. By clarifying the relative weight of local versus regional factors, this study evaluates whether integrating regional-scale processes into biomonitoring could enhance ecological assessment under the WFD.

Patrones composicionales y valor ecológico de las comunidades de diatomeas fluviales

Manel Leira[1], Núria Flor Arnau[2]*, Toni Monleón-Getino[2]

[1]Universidade de Santiago de Compostela, [2]Universitat de Barcelona

n.flor@ub.edu

Los programas de biomonitorización utilizan las comunidades de referencia para evaluar el estado ecológico de los ecosistemas, pero su coherencia interna y como se diferencian de las estaciones de no referencia no siempre se han analizado en detalle. Aquí se examina la composición de las comunidades de diatomeas en distintas tipologías fluviales ibéricas, incluyendo localidades de referencia y sometidas a presión, descomponiendo la betadiversidad en turnover y nestedness y explorando su relación con el IPS. Los resultados arrojan diferencias significativas entre tipologías, organizadas en dos grandes bloques coherentes con patrones geológicos y climáticos dominantes. En cada tipología, las estaciones de referencia muestran composiciones medias distintas de las de no referencia y una varianza interna sistemáticamente menor. Esto indica que la categoría "referencia" posee un fundamento ecológico consistente y refleja una homogeneidad relativa respecto a los sitios sometidos a presiones. No obstante, esta homogeneidad no es absoluta: incluso dentro de las referencias se observa una variabilidad composicional apreciable. La dispersión de los sitios de no referencia es mayor y puede solaparse con la de los de referencia cuando los valores IPS no son muy bajos. Esto sugiere que la diferenciación entre ambos grupos no siempre se traduce en comunidades claramente separadas y que la variabilidad inducida por distintos tipos de alteración ambiental puede difuminar los límites composicionales esperados. Finalmente, el turnover domina la betadiversidad en todas las tipologías, confirmando que la degradación procede principalmente por reemplazo de especies sensibles y respaldando el fundamento conceptual del IPS. En tipologías con estrés múltiple, la relación IPS–turnover es no lineal y el enriquecimiento en nutrientes reduce la fracción de turnover independientemente del valor del índice, lo que revela un componente de nestedness no captado por el IPS y sugiere que distintos tipos de presión generan trayectorias composicionales diferentes para valores similares del índice.

Deterioro temporal de la calidad del agua del Río Luján, Argentina

Ana M. Torremorell[1,2], Carolina Vilches[1,2], Martina M. Mastrángelo[1,2], Aníbal Sánchez Caro[1,2], María Luz Padulles[1,2], Emiliano Camilli[1,2], Andrés Pighin[1,2], Adonis Giorgi[1,2]*

[1]INEDES (CONICET-UNLu]), R N. 5 y Av. Constitución,6700, Luján, Argentina. [2]Dpto. Cs. Básicas-Univ. Nac. de Luján. R. N. 5 y Av. Constitución,6700, Luján, Argentina

adonisgiorgi16@gmail.com

La cuenca del río Luján se ha utilizado tradicionalmente para la producción agrícola y ganadera extensiva. Actualmente, con el crecimiento urbano, los pastizales naturales están siendo reemplazados por cultivos y la actividad industrial también se está expandiendo. El objetivo de este estudio es brindar un panorama actualizado de la calidad del agua del río Luján desde su nacimiento en la localidad de Suipacha hasta la cuenca baja entre las localidades de Escobar y Campana. Se realizaron cuatro muestreos estacionales, durante 2022 (febrero, mayo, agosto, noviembre), en diez sitios distribuidos a lo largo de las cuenca. Se recolectaron muestras de agua para la determinación de los parámetros físicos y químicos necesarios para describir la calidad del agua. También se identificaron las especies de algas planctónicas y bentónicas como indicadores biológicos. Se detectaron altas concentraciones de fosfatos, nitratos, amonio, carbono orgánico disuelto, conductividad y algunos metales pesados, lo que indica un deterioro significativo del agua del río, particularmente en la cuenca alta. La comparación interanual realizada con información de 16 años atrás indicó un aumento en las señales de eutrofización y de la materia orgánica particulada, así como un deterioro progresivo en algunos sectores del río de la cuenca alta y media. Estos patrones fueron consistentes con los cambios observados en las comunidades algales planctónicas y bentónicas, que reflejan claramente los cambios temporales y espaciales asociados a la intensificación de las presiones antrópicas.

Development and application of a Benthic and Fish multimetric index for tropical reservoirs

Karoline Madureira[1]*, Marden Linares[1], Diego Macedo[1], Paulo Pompeu[2], Gilberto Salvador[1], Carlos Alves[1], Rosalva Suzbacher[2], Gilmar Santos[3], Barbara Sanches[4], Barbara Becker[3], Marcos Callisto[1]

[1]Universidade Federal de Minas Gerais, 31270-901, Belo Horizonte, Brazil. [2]Universidade Federal de Lavras, 37203-202, Lavras, Brazil. [3]Pontifícia Universidade Católica de Minas Gerais, 30535-901, Belo Horizonte, Brazil. 4Log Nature, 30180-106, Belo Horizonte, Brazil

karolhmadureira@gmail.com

Multimetric indices (MMIs) are widely recognized as effective tools for assessing ecological conditions, but their application in tropical reservoirs remains limited and lacks standardized and transferable approaches. In the present study, we developed a MMI, validated it, and tested the MMI transferability, integrating littoral benthic macroinvertebrates and fish to assess ecological condition in tropical hydropower reservoirs. The index was developed in the Furnas Reservoir (Upper Rio Grande basin, southeastern Brazil) in 40 littoral sites selected through a spatially systematic sampling design. A quantitative disturbance gradient was established using an Integrated Disturbance Index (IDI) based on land use and riparian disturbance, and we used it to classify sites according to their local ecological conditions. From an initial set of 191 candidate biological metrics, a rigorous multi-stage selection process, considering metric breadth, frequency of zero values, discrimination between ecological classes, responsiveness to the IDI, and redundancy, resulted in nine final metrics. These metrics include taxonomic richness, proportions of tolerant and sensitive taxa, occurrence of non-native species, community diversity, and functional and life cycle characteristics of macroinvertebrates and fishes. All metrics were standardized on a 0-100 scale, and the average was calculated to generate the final MMI score. The MMI showed strong, significant negative correlations with the IDI in both the development ($\rho = -0.75$; $p < 0.001$) and validation ($\rho = -0.70$; $p < 0.01$) datasets, indicating high sensitivity and robustness. When applied to four additional previously sampled Brazilian reservoirs, the MMI showed significant negative relationships with the IDI in three systems (ρ ranging from approximately −0.43 to −0.48; $p \leq 0.005$), corroborating its transferability. Overall, this multi- rate MMI provides a robust, practical, and low-cost framework for assessing ecological condition, supporting monitoring programs, guiding littoral zone rehabilitation, and informing sustainable management decisions and public policies in tropical hydroelectric reservoirs.

Zooplankton functional diversity in a large fluvial Mediterranean watershed

Manuel Muñoz-Colmenares[1]*, Sergio González-Gutiérrez[2], Juan Víctor Molner[1], Noelia Campillo-Tamarit[1], Juan M. Soria[1]

[1]Cavanilles Institute of Biodiversity and Evolutionary Biology (ICBiBE), University of Valencia, Catedràtic José Beltrán Martínez, 2, 46980 Valencia, Spain. [2]Postgraduate Program in Marine Sciences and Limnology, National Autonomous University of Mexico, Circuito Exterior s/n Ciudad Universitaria, Mexico City 04510, Mexico

manuel.e.munoz@uv.es

Zooplankton has a fundamental position in water food webs and plays an important role inside aquatic systems. Research on freshwater zooplankton is vast and diverse; however, studies focused on their functional diversity are scarce compared with other fields. The Functional Richness, Functional Evenness, Functional Divergence, and Functional Dispersion indices are based on the combination of species abundance and specific traits unlike traditional indices. In the present research, we evaluated these functional indices and the environmental, morphological, and classification variables that shape them. Water samples were obtained from several reservoirs of the Ebro watershed, which is the largest in Spain. More than 60 reservoirs were sampling during summertime from 2010 to 2025. The zooplankton community was composed of more than 150 species. Environmental variables related to the functional indices were mainly conductivity and phytoplankton biomass. Morphological variables such as reservoir´s volume and depth together with the classification of the reservoir´s trophic state and ecological status were also related. The functional indices indicate how communities use the resources, their functional distribution, and how different they are. The indices' variation through time and space has the potential to detect changes in the community composition and the impact of human activities.

Integrating environmental and remote sensing data for large-scale modelling of riparian habitats across Europe

Giorgio Pace[1,2]*, Simao Freitas[1,2], Stefano Larsen[3], Maria Cristina Bruno[3], Micael Jonsson[4], Giulia Cesarini[5], Luca Gallitelli[5], Claudia Carvalho-Santos[1,2], Monika Laux[7], Massimiliano Scalici[5,6], Ralf Schulz[7], R. Henriques[8], Cláudia Páscoal[1,2], José Barquin[9], Laura Concostrina- Zubiri[9]

[1]Centre of Molecular and Environmental Biology (CBMA) / Aquatic Research Network (ARNET) Associate Laboratory, Department of Biology, University of Minho, Braga, Portugal. [2]Institute of Science and Innovation for Bio-Sustainability (IB-S), University of Minho, Braga, Portugal. [3]Research and Innovation Centre, Fondazione Edmund Mach, Via Mach 1, 38098 S. Michele all'Adige, Italy. [4]Department of Ecology, Environment and Geoscience, Umeå University, 90187 Umeå, Sweden. [5]University of Roma Tre, Department of Sciences, Viale Guglielmo Marconi, 446 00146 Rome, Italy. [6]National Biodiversity Future Center (NBFC), Università di Palermo, Piazza Marina 61, 90133 Palermo, Italy. [7]Institute for Environmental Sciences, RPTU – University of Kaiserslautern-Landau, Landau, Germany. [8]Department of Earth Sciences, University of Minho, Institute of Earth Sciences (ICT), Campus of Gualtar, 4710-057 Braga, Portugal. [9]IHCantabria, Instituto de Hidráulica Ambiental de la Universidad de Cantabria, Santander, Spain.

giorgio.pace@bio.uminho.pt

Riparian zones are transitional ecotones between aquatic and terrestrial ecosystems that play a disproportionate role in sustaining regional biodiversity. Yet they are among the most threatened ecosystems worldwide. In Europe, up to 90% of stream floodplains are considered ecologically degraded due to land-use change, hydromorphological alteration, and climate change. Achieving the targets of the EU Biodiversity Strategy for 2030 and the EU Nature Restoration Law, requiring the protection of at least 30% of Europe's land and sea and the restoration of at least 20% of degraded ecosystems by 2030, demands spatially explicit, high-resolution information to support evidence-based conservation and restoration planning. However, mapping riparian habitats at national to continental scales remains challenging because of their narrow, linear configuration and pronounced spatial and temporal heterogeneity. To address this gap, we developed an integrated framework to characterize riparian vegetation across entire river networks. The study encompassed six river basins spanning four European biogeographic regions: Boreal (Sävar, Sweden), Continental (Queich and Lauter, Germany), Alpine (Noce, Italy), and Atlantic (Saja, Spain; Cávado, Portugal). We integrated Sentinel-2 and LiDAR-derived metrics with open-access climatic, edaphic, and topographic variables, which were cross-validated with Random Forest models and field data, to identify environmental drivers and remote sensing indicators able to identify and characterize the key EUNIS Level 3 habitats. By analyzing 948 riparian patches, and 30 different EUNIS riparian habitats, we found that environmental controls varied by region: elevation and climate variability were primary drivers in Alpine and Atlantic zones, whereas soil texture (particularly silt and clay content) dominated in Boreal and Continental regions. LiDAR-derived structural metrics reflecting vegetation complexity, together with Sentinel-2 NDVI, capturing spatial variability in canopy greenness and potential productivity, enhanced habitat discrimination across all biogeographic regions. Overall, our approach advances riparian habitat characterization by providing a transferable, data-driven framework that supports large-scale monitoring, prioritization of conservation and restoration actions, and evidence-based management under ongoing environmental change.

Validación y calibración de modelos empíricos para la estimación de parámetros de calidad del agua en los embalses de Guadalest y Amadorio mediante imágenes Sentinel-2

Lissette Sánchez[1]*, Gabriel Caballero[1], Xavier Sòria-Perpinyà[1], Bárbara Alvado[1], Antonio Ruíz-Verdú[1], Eduardo Vicente[2], Juan M. Soria[2], Concha Durán[3], Damián Ortega[3], Jesús Delegido[1]

[1]Laboratorio de Procesado de Imágenes, Universitat de València. C/ Catedrático José Beltrán, 2. Parc Científic. 46980, Paterna, València, España. [2]Cavanilles Institute of Biodiversity & Evolutive Biology, Universitat de València, Catedràtic José Beltrán Martínez 2, Paterna, Spain. [3]Confederación Hidrográfica del Júcar, Avenida de Blasco Ibáñez 48, Valencia, España

sanpelis@uv.es

La monitorización de la calidad del agua mediante teledetección se ha consolidado como una herramienta eficaz para el seguimiento espacial y temporal de variables clave en embalses mediterráneos, permitiendo evaluar su dinámica ecológica frente a presiones climáticas y antrópicas. Sin embargo, la aplicabilidad operativa de los algoritmos desarrollados para estimar estos parámetros depende en gran medida de su capacidad de transferirse entre sistemas acuáticos con características tróficas y ópticas similares. El presente estudio evalúa la precisión y transferibilidad de algoritmos previamente calibrados en embalses de la cuenca del Júcar, aplicándolos a los embalses de Guadalest y Amadorio. Para ello, se utilizaron imágenes Sentinel-2 nivel 2A obtenidas a través del portal Copernicus. Los valores de reflectancia se extrajeron a partir del valor medio de los píxeles localizados en torno a las coordenadas de los puntos de muestreo, con el fin de aproximar las condiciones observadas en campo. Sé comparó el desempeño de los modelos originales frente a versiones reajustadas localmente, utilizando como métrica principal el error cuadrático medio (RMSE). Para garantizar coherencia en los datos de referencia, previamente se aplicó un ajuste lineal entre mediciones de clorofila-a de campo y laboratorio, con el fin de homogeneizar ambas fuentes antes de la validación satelital. Los resultados muestran que los modelos permiten estimar la clorofila-a mediante imágenes Sentinel-2 con errores normalizados (NRMSE) comprendidos aproximadamente entre 12 % y 26 % en el embalse de Guadalest, mientras que en Amadorio los errores varían entre 31 % y 74 %, dependiendo del algoritmo aplicado. Estas diferencias evidencian que la transferibilidad de los modelos no es homogénea entre embalses y que en determinados sistemas, puede ser necesaria una recalibración local para mejorar la precisión de las estimaciones.

Effects of anthropogenic disturbance on water quality in a hydropower reservoir in Southeast Brazil

Anderson Santos da Rocha[1]*, Luana Caiafa[2], Marcos Callisto[1]

[1]Laboratório de Ecologia de Bentos, Departamento de Genética, Ecologia e Evolução, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil. [2]Centro de Síntese Ecológica e Conservação, Departamento de Genética, Ecologia e Evolução, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil

anderson.asdr@gmail.com

To assess water quality, continuous monitoring is required. A Water Quality Index (WQI) can summarize water quality using a small number of parameters. With the objective of assessing the water quality of the Furnas Hydroelectric Reservoir and determining the most important variable in distinct disturbance conditions, a surface water sampling plan was developed at 40 sampling sites in the reservoir's littoral region and 40 stream sites. These 80 sites were classified along a gradient of disturbance from human activities into three categories: maximum ecological potential (reference), intermediate, and impacted. Physical, chemical, and biological variables were determined and compared with the Water Quality Index of the Minas Gerais Institute of Water Management (WQI-IGAM). Based on this index, most sites had good water quality in both streams and reservoir sites (60% and 62.5%, respectively). In these ecosystems, the WQI did not correlate with the integrated impact categories. For reservoir sites, some variables, such as electrical conductivity (EC), total dissolved solids (TDS), and *Escherichia coli*, were more associated with degraded sites, whereas dissolved oxygen (DO) and the WQI were more related to maximum ecological potential sites, in intermediate impacted sites showed greater influence from total phosphorus and the Trophic State Index (TSI). In streams, degraded areas showed greater dispersion and were associated with turbidity, E. coli, EC, TDS, and total phosphorus, whereas reference sites were associated with DO, pH, and WQI. Highly impacted areas were associated with physical parameters that may be related to sedimentation and the discharge of domestic effluents, whereas reference areas confirmed the importance of the WQI for environmental monitoring and management in the Furnas Hydroelectric Reservoir watershed.

Disentangling environmental and spatial drivers of macroinvertebrate taxonomic and functional diversity in alpine ponds

Irene Tornero[1]*, José A. Carbonell[1], Eduardo Franco-Fuentes[1], David Sánchez-Fernández[2], Félix Picazo[3], Marina Jiménez-Ruiz[1], Manuel Villar-Argáiz[3], Andrés Millán[2], Pedro Abellán[1]

[1]Department of Zoology, Faculty of Biology, University of Seville, Seville, Spain. [2]Department of Ecology and Hydrology, University of Murcia, Murcia, Spain. [3]Departamento de Ecología, Facultad de Ciencias, Universidad de Granada, Spain

itornero@us.es

Community assembly is shaped by the interplay between deterministic and stochastic processes. The harsh environmental conditions, together with the isolated and fragmented nature of montane habitats, make alpine pond systems particularly suitable for investigating metacommunity dynamics. However, the drivers underlying their diversity patterns remain poorly understood. We sampled macroinvertebrate communities from 29 ponds in the Sierra Nevada massif, located between approximately 2,500 and 3,090 m a.s.l. We evaluated the relative influence of environmental and spatial factors on both taxonomic and functional beta diversity. Specifically, we examined turnover and nestedness components, as well as multiple functional diversity metrics. Generalized dissimilarity models were used to analyze beta diversity patterns, and beta regression models were applied to functional diversity metrics. Taxonomic beta diversity was primarily driven by turnover. Moreover, the standardized effect size (SES) of taxonomic nestedness was significantly higher than expected under a null model. In contrast, SES values for functional beta diversity were randomly distributed, suggesting that stochastic processes may play an important role in shaping these communities. Elevation, degree centrality, and pond size emerged as the main drivers of spatial variation among communities. Overall, both taxonomic and functional beta diversity were explained by a combination of environmental and spatial factors. The exceptions were total taxonomic beta diversity and the taxonomic nestedness component, which were driven exclusively by environmental variables. Our findings highlight the complementary value of taxonomic and functional approaches and underscore the importance of considering multiple facets of biodiversity to better understand metacommunity structure of alpine ponds.

Nutrient status drives contrasting photosynthesis-irradiance curves in river biofilms

Mireia Aranbarri*, Miriam Colls, Arturo Elosegi, Maite Arroita

Department of Plant Biology and Ecology, University of the Basque Country (EHU),48940, Leioa, Spain

mireia.arambarri@ehu.eus

Photosynthesis–irradiance (P-I) relationships are widely used to parameterize gross primary production (GPP) in stream metabolism models. However, most formulations derive from planktonic cultures and assume optically homogeneous communities. Whether these classical models adequately represent structurally complex river biofilms, particularly under interacting light and nutrient conditions, remains unresolved. We experimentally tested how nutrient availability and growth irradiance shape the functional form of community-level P-I curves by growing natural stream biofilms for one month in 30 indoor flumes under five growth irradiances (60-880 µmol m^{-2} s^{-1}) and two nutrient concentrations (low vs. high). We quantified chlorophyll- a biomass, GPP, and community respiration, and analysed GPP responses across an incubation light gradient by fitting and comparing linear, saturating, and inhibitory P-I models using AICc selection. The functional form of the curves differed fundamentally between nutrient treatments. Under low nutrient conditions, biofilms remained thin and GPP increased linearly with irradiance, with no evidence of light saturation or photoinhibition. In contrast, high nutrient conditions promoted greater biomass accrual and exhibited clear saturating responses, with steeper initial slopes, finite maximum production, but no photoinhibition. The irradiance under which biofilm grew further modulated P-I curves under high nutrient conditions, with intermediate growth irradiance yielding the highest production and the earliest approach to saturation. Together, these findings indicate that the shape of community-level P-I relationships in river biofilms is an emergent property of biofilm developmental state shaped by nutrient availability and light history, highlighting the context dependency of light limitation in stream ecosystems.

Mitigation through restoration: reducing carbon gas emissions in alpine lakes

Iñigo Arnedo[1]*, Anna Lupon[1], Ada Pastor[2], Arnau Comas[3], Carolina Olid[4], Nuria Burgada[5], Laure Gandois[6], Marc Ventura[1], Teresa Buchaca[1], Esperança Gacia[1], Núria Catalán[1]

[1]CEAB-CSIC, Carrer Accés Cala Sant Francesc, 14, 17300 Blanes, Girona, Spain. [2]Institut d'Ecologia Aquàtica, Maria Aurèlia Capmany, 69, 17003 Girona, Spain. [3]IDAEA-CSIC, Jordi Girona 18-26, 08034, Barcelona, Spain. [4]UB-Geomodels Research Institute, Departament de Dinàmica de la Terra i l'Oceà, Facultat de Ciències de la Terra, Universitat de Barcelona, 08028 Barcelona, Spain. [5]Fundació Kilian Jornet, Terra Negra, 2, 25725 Montellà del Cadí, Lleida, Spain. [6]Laboratoire Ecologie Fonctionnelle et Environnement (UMR 5245), CNRS, Avenue de l'Agrobiopole – BP 31326 Castanet Tolosan Cedex, France

inigo.arnedo@ceab.csic.es

Lakes play a crucial role in the global carbon cycle, though it remains unclear whether they act globally as net greenhouse gas (GHG) sources or sinks. Alpine lakes are sentinel ecosystems undergoing rapid climate-driven alterations, yet their specific carbon dynamics remain poorly constrained. Human activities, such as the introduction of invasive fish, can further disrupt their carbon balance by promoting eutrophication and altering ecosystem metabolism. Here, we tested the potential of biodiversity recuperation for reducing CO_2 emissions by comparing two Pyrenean alpine lakes: Lake Tres Estanys de Baix (TEB), subject to eutrophication driven by invasive fish, and Lake Naorte, where invasive fish were nearly eradicated through two European LIFE projects. In 2023, sensor-equipped platforms gathered continuous weather, oxygen, and coupled CO_2 and O_2 data across depths, alongside weekly nutrient and dissolved organic matter (DOM) sampling. Naorte demonstrated remarkable recovery, with improved water clarity, and functioned as a consistent net sink of atmospheric CO_2. In TEB, DOM was more colored, dissolved organic carbon and nitrogen were higher, and nutrient imbalances indicated disrupted metabolism. We assessed ecosystem functioning and dynamics by modeling lake stability with the General Lake Model (GLM) using local meteorological data, coupled with metabolic modeling via LakeMetabolizer. We also calculated CO_2 and O_2 departures from equilibrium to determine internal gas fluxes and exchange between the lake and the atmosphere. While TEB's surface layer was net autotrophic, the bottom layer—isolated from atmospheric exchange and without light—remained heterotrophic throughout the study. The CO_2 and O_2 departures revealed the consequences of this dynamic: although TEB also acted as a net carbon sink during stratification, CO_2 accumulated heavily in the bottom layer. Storms and late-summer mixing events drove significant increases in CO_2 departures, resulting in substantial net fluxes of CO_2 to the atmosphere. During the entire study period, Naorte functioned as a net carbon sink, whereas TEB acted as a strong carbon source after summer stratification.

Effects of nanoplastics and copper on oxidative stress and functional performance of freshwater fungal communities

Juliana Barros*, Sarra Ben Tanfous, Manuel Graça, Sahadevan Seena

Marine and Environmental Science Centre (MARE) / Aquatic Research Network (ARNET), Department of Life Sciences, University of Coimbra, Coimbra, Portugal

julibatistabarros@gmail.com

Freshwater ecosystems are increasingly exposed to contaminant mixtures, such as nanoplastics (NPs; ≤ 1 µm) and metals, yet their combined impacts on microbial communities, particularly fungal decomposers remain underexplored. This study evaluated the effects of environmentally relevant and elevated concentrations of bare and carboxylated NPs (1 and 100 µg L^{-1}) and copper (Cu; 50 µg L^{-1}), individually and in combination, on freshwater fungal communities colonizing leaf litter. Oxidative stress biomarkers (metallothionein and hydrogen peroxide) and antioxidant enzyme activities (superoxide dismutase, catalase and glutathione peroxidase) were quantified alongside functional endpoints, including aquatic hyphomycete sporulation rates, community composition and microbial leaf litter decomposition. Results demonstrated that carboxylated NPs, particularly in combination with Cu, elicited the strongest biochemical responses, characterized by a coordinated activation of antioxidant defenses. While fungal community composition remained stable, the metabolic cost of redox homeostasis regulation resulted in functional impairment, reducing sporulation and decomposition by 30% and 14%. These findings demonstrate the critical influence of NP surface functionalization in modulating contaminant mixture toxicity and highlight the sensitivity of functional endpoints as indicators of sublethal stress. Collectively, they underscore the importance of adopting integrated, multi-stressor risk assessments to better understand and manage freshwater contamination.

Hydrological seasonality and salinity regulate ecosystem metabolism in the Gambia River (West Africa)

Elsa Bisbal[1]*, Iñigo Arnedo[2], Daniel von Schiller[1], Camille Minaudo[1], Pablo Rodríguez-Lozano[3], Amuzo Nkamnebe[4], Mamadou Jasseh Faal[4], Anna Lupon[2], Núria Catalán[2]

[1]Universitat de Barcelona, Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Av. Diagonal, 643, Les Corts, 08028 Barcelona, Espanya. [2]Centre d'Estudis Avançats de Blanes, CSIC, Carrer Accés Cala Sant Francesc, 14, 17300 Blanes, Espanya. [3]Universidad Autonoma de Madrid, Departamento de Ecología, C. Darwin, 2, Fuencarral-El Pardo, 28049 Madrid, Espanya. [4]GREAT institute, Coastal Rd, Brusubi, Gambia

ebisbal@ub.edu

Ecosystem metabolism plays a central role in determining whether rivers function as net carbon sources or sinks, yet its controls in tropical tidal systems remain poorly quantified. In the Gambia river (West Africa), pronounced seasonality and increasing salinization associated with sea-level rise and water diversion may substantially alter the balance between gross primary production (GPP) and ecosystem respiration (R), thereby influencing coupled CO_2–O_2 dynamics. Quantifying how these drivers affect metabolic balance is essential to better constrain regional carbon budgets. To evaluate this, we assessed seasonal variability in metabolic status at two contrasting reaches of the Gambia River: an upstream freshwater station and a downstream transitional zone that becomes slightly saline during the dry season. Dissolved O_2 and CO_2 sensors, together with meteorological and light sensors, were deployed for 3–6 days during three hydrological periods: dry (May), transition (July), and wet (November). Using paired O_2–CO_2 measurements, we calculated departures from atmospheric equilibrium as proxies for metabolic activity and net ecosystem production. At the freshwater station, O_2–CO_2 departures varied markedly among seasons. The transition period following the first rains showed higher O_2 relative to CO_2 departures, indicating enhanced autotrophic conditions and the only episodes of positive net production. In contrast, dry and wet seasons were characterized by greater CO_2 than O_2 departures, consistent with net heterotrophy, although variability was higher during the dry season. At the downstream station (sampled only in the dry and wet seasons), O_2:CO_2 departure ratios increased during the wet season, suggesting enhanced primary production likely associated with reduced salinity. However, heterotrophic conditions persisted in both seasons. The combined analysis of O_2 and CO_2 departures provides a powerful and still scarcely applied approach in large or tidal rivers. By capturing coupled gas dynamics, this method offers novel insights into metabolic balance and seasonal carbon processing in West African tidal systems.

River network modelling reveals dry riverbeds as major CO2 sources in intermittent rivers

Alba Camacho-Santamans[1,2]*, Biel Obrador[1,3], Enrico Bertuzzo[4], Daniel von Schiller[1,2]

[1]Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals (BEECA), Universitat de Barcelona (UB), Barcelona, Spain. [2]Institut de Recerca de l'Aigua (IdRA), Universitat de Barcelona (UB), Barcelona, Spain. [3]Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona (UB), Barcelona, Spain. [4]Ca' Foscari University of Venice, Department of Environmental Sciences, Informatics and Statistics, Venezia (VE), Italy

a.camacho-santamans@ub.edu

Aquatic systems worldwide are undergoing increasing episodes of contraction and drying as a consequence of climate change and human pressures, leading to alterations in hydrological connectivity and biogeochemical functioning. Drying-rewetting transitions redefine how carbon (C) is processed, stored, and released across fluvial networks, yet their implications for C emissions remain poorly quantified at such scale. While C dynamics under flowing conditions has been widely investigated, exposed sediments that emerge during dry phases are rarely considered in regional or annual C budgets. Here, we developed a modelling framework to assess the contribution of intermittently exposed riverbed sediments to total carbon dioxide (CO_2) emissions at the river network scale. The model was implemented in a synthetic Mediterranean-type network and explicitly simulated the spatial and temporal expansion and contraction of the river. Areal CO_2 fluxes from inundated areas were considered constant, whereas fluxes from exposed sediments varied dynamically, with an initial post-drying pulse driven by enhanced microbial activity followed by a progressive decline along decreasing moisture. We explored a range of hydroclimatic scenarios, including differences in rainfall regime, flow flashiness, flow persistency and longitudinal drying patterns. The results showed that drying dynamics strongly controlled CO_2 fluxes at the network scale. Under reference conditions, exposed sediments accounted for 40% of total annual fluxes, with the highest contribution in upstream sections that declined with drainage area. Changes in the hydrological regime modified both total fluxes and the relative importance of wet and dry areas. Higher flow flashiness increased overall fluxes and enhanced the contribution of dry areas, while lower rainfall frequency and reduced water persistence further amplified the dominance of dry areas in the total annual fluxes. These findings emphasize the need to account for drying riverbeds in C budget assessments at large scales, especially as droughts become more frequent in a changing climate.

Macrophyte architectural complexity increases phosphorus retention: an experimental approach

Claudia Feijoó[1]*, Liria Belén Campos[1], Emilia Zelaya Soulé[1], Nicolás Ferreiro[1], Rolando Caravallo[1], Francesc Sabater[2], Adonis Giorgi[1]

[1]Instituto de Ecología y Desarrollo Sustentable (INEDES, CONICET-UNLu), Luján, Argentina. [2]Departamento de Biología Evolutiva, Ecología y Ciencias Ambientaes, Facultad de Biología, Universitat de Barcelona, Spain.

clasife@yahoo.edu.ar

Environmental heterogeneity may promote a more efficient use of resources due to the coexistence of several species adapted to different niches. In some aquatic ecosystems, environmental heterogeneity is provided by macrophytes, which in turn may stimulate some ecosystem functions such as nutrient retention. Here, we explored the role of plant architectural complexity (measured as fractal dimension) on phosphorus retention in laboratory experiments. Phosphorus uptake was estimated in: (a) three macrophyte species with different complexity (first experiment), (b) two macrophyte species with similar complexity (second experiment), and (c) shoots of different complexity of the same species (third experiment). The first experiment showed that phosphorus retention was higher in the more complex species, while we found no differences in phosphorus retention in species of similar complexity (second experiment). Finally, complex shoots showed higher phosphorus retention than simple shoots of the same species (third experiment). Our results showed that macrophyte architectural complexity enhances phosphorus retention in aquatic environments. This should be considered in the design of stream restoration projects if we want to enhance nutrient uptake.

Restoration and functioning of the ecosystem in tropical streams: Impact of agricultural stressors on leaf litter decomposition and primary producers

Gabriela García[1], Javier Pérez[2,3,10], Alberto Alonso[3], Diana Rojo[3], Tomás Ríos[4], Pablo Gutiérrez-Moreno[2], Fátima Pineda[2,5], Fermín Hernández[6], Kathia Broce[7,8,9], Luz Boyero[2,3,11], Aydeé Cornejo[2,3,9]*

[1]Doctoral Program in Biosciences and Biotechnology, Faculty of Science and Technology, Technological University of Panama, Panama City 0819-07289, Panama. [2]Ecology and Aquatic Ecotoxicology Laboratory, Research Center for Emerging and Zoonotic Diseases, Gorgas Memorial Institute of Health Studies, Santiago Este 0816-02593, Veraguas, Panama. [3]Department of Plant Biology and Ecology, Faculty of Science and Technology, University of the Basque Country EHU, Leioa, Spain. [4]Museum of Freshwater Fish and Invertebrates (MUPADI), Autonomous University of Chiriqui (UNACHI), David City, Panama. [5]Faculty of Agronomy, University of Panama (UP), David City, Panama. [6]Grupo para la Educación y Manejo Ambiental Sostenible (GEMAS), Panama City, Panama. [7]Center for Multidisciplinary Studies in Science, Engineering and Technology, CEMCIT-AIP, 0819-07289 Panama City, Panama. [8]Center for Hydraulic and Hydrotechnical Research, Technological University of Panama, Panama City 0819- 07289, Panama, Panama. [9]National Research System (SNI), National Secretariat of Science, Technology and Innovation (SENACYT), Panama City 0816-02852, Panama. [10]Department of Biology and Geology and Andalusian Center ENGLOBA, University of Almería (UAL), Almería, Spain. [11]IKERBASQUE, Basque Foundation for Science, Bilbao, Spain.

aurealuizalemes@ua.pt

Agricultural activities in the watershed deteriorate ecosystem processes and biological communities in tropical streams. To examine the success of recent riparian forest restoration efforts in three streams of the Panama Canal Watershed, we evaluated their structural and functional integrity: total and microbial leaf litter decomposition, periphytic algal accrual, and associated communities. In each stream, three reaches were selected: control (tropical rainforest), disturbed (without riparian cover), and restored (riparian vegetation recovered). Structural integrity was assessed using riparian variables, physicochemical parameters, and biotic indices (e.g., EPT, BMWP/PAN). Leaf litter decomposition was evaluated by incubating coarse- and fine-mesh litterbags containing *Ficus*, *Cecropia*, and *Anacardium* leaves, and periphyton accrual on marble tiles. We expected disturbed reaches to exhibit lower decomposition rates and higher periphyton accrual than control reaches, with restored ones showing intermediate values. Rural populations supported deployment and collection of samples through a gender-inclusive participatory science approach. Riparian variables differed among reaches; canopy cover was higher in restored than in disturbed sites. Macroinvertebrate communities exhibited low detritivore abundance in most samples, a common feature of tropical streams, which limited the detection of clear patterns of structural impact or recovery. Leaf litter type was the main determinant of decomposition rates, with microbial decomposition representing the dominant component in all cases. Restoration success varied according to the local context, with few examples supporting the expected patterns. However, periphyton accrual tended to be consistently higher in disturbed reaches than in control and restored ones. Our results highlight the importance of evaluating restoration on a case-by-case basis, considering local context as a key driver of ecosystem response. This is particularly relevant for tropical streams, where knowledge of functional restoration remains limited and frameworks derived from temperate systems are not directly applicable,

reinforcing the need to generate empirical evidence to guide management and ecosystem restoration in tropical regions.

Thermal variability in mountain streams and its role in multitrophic metabolic rates

Alexia M. González-Ferreras[1]*, Eoin J. O'Gorman[2], Mario Álvarez-Cabria[1], Francisco J. Peñas[1], Raquel Zarauza-Martínez[1], Iria Río-Lado[1], Peter Betts[2], José Barquín[1]

[1]IHCantabria - Instituto de Hidráulica Ambiental de la Universidad de Cantabria, 39011 Santander, Spain. [2]School of Life Sciences, University of Essex, Wivenhoe Park, Colchester, CO4 3SQ, UK

gferrerasam@unican.es

Mountain streams play a fundamental role in the structure and functioning of fluvial networks. These streams commonly arise from two main sources: 1) groundwater-fed springs, which are characterized by relatively stable water temperatures, or 2) headwater zones, where steep slopes, high relief, and precipitation inputs promote channel initiation and result in more variable water temperatures. These different thermal regimes provide a useful framework for examining climate change impacts, as climate change is modifying both the mean and the variability of temperatures with larger and more frequent temperature fluctuations predicted. Metabolic rates of stream-dwelling organisms are highly temperature-dependent, thus they will most likely be impacted by warming. Ectothermic organisms, which make up the majority of riverine organisms, are particularly vulnerable to elevated temperatures, as warming increases their metabolic demand. In this study, we analyze in situ estimation of oxygen consumption rates (as a proxy for metabolic rates) across different compartments of the fluvial ecosystem (e.g. fish, biofilm) in six mountain streams within the Deva-Cares and Sella catchments (Northern Spain). The streams included in our study exhibit contrasting natural thermal regimes, with some remaining thermally stable over the year and others thermally variable. Our preliminary results find that metabolic rate is more sensitive to increasing temperatures in thermally variable streams, suggesting that organisms can achieve higher metabolic rates under these conditions. However, this response is likely to increase the total carbon emitted through ecosystem respiration, underscoring the importance of including thermal variability in models predicting future climatic impacts on ecosystem functioning. Our findings could be further tested across broader thermal regimes and diverse geographic regions to better understand the resilience of organisms experiencing variable or stable thermal regimes in the face of current climate change.

Aquatic biodiversity, ecosystem functioning relationship in streams facing urbanization pressures

Aurea Luiza Lemes da Silva[1,2]*, Rafael Schmitt[1], Salomé Fernandes Pinheiro de Almeida [1], Maria João Feio[2]

[1]Department of Biology, GeoBioSciences, GeoTechnologies and GeoEngineering (GeoBioTec) Research Centre, University of Aveiro, 3810-193 Aveiro, Portugal. [2]Department of Life Sciences, Faculty of Sciences and Technology, University of Coimbra, Marine and Environmental Sciences Centre (MARE), Associate Laboratory ARNET, Coimbra, Portugal.

aurealuizalemes@ua.pt

Freshwater ecosystems are facing a progressive loss of biodiversity and disruption of their ecosystem processes. Among other causes, urbanization, which is expanding around the world, results in major stresses that affect stream and river ecosystems. Yet, those effects on aquatic biodiversity and, especially, on the ecosystem functioning and on the link between them, are still understudied. To address this gap, an experimental approach using coarse-mesh bags filled with *Populus nigra* leaves was performed to assess their breakdown rate and the role of aquatic invertebrates in mediating leaf litter decomposition. The experiment was carried out in thirteen urban streams in Aveiro, Portugal. The streams had different levels of degradation, including a wide range in nitrate concentrations, up to 20 mg/L in the most urbanized areas. Aquatic invertebrate communities included 3,504 individuals that were morphologically identified and classified according to trophic groups. Shredders (e.g., Calamoceratidae) were present in the streams with a higher quality, while the most common families at all sites were Chironomidae and Oligochaeta. Our results also revealed a significant variation in the decomposition rates among streams, with a decline in the breakdown rates at urban sites. In contrast, faster decomposition rates were recorded in streams located farther from the urban center, particularly in those with a higher richness of invertebrates and of shredders. Overall, our findings indicate that urbanization disrupts the biodiversity–ecosystem functioning relationship in streams, leading to reduced leaf litter decomposition rates and highlighting the need to incorporate ecosystem functioning into urban stream management and planning.

Multiple drivers of leaf litter decomposition under salinity stress

Diana Rojo[1]*, Raymond P. Kidder[2], Checo Colón-Gaud[2], Luz Boyero[1,3]

[1]Department of Plant Biology and Ecology, Faculty of Science and Technology, University of the Basque Country EHU, Barrio Sarriena s/n, 48940, Leioa, Spain. [2]Department of Biology, Georgia Southern University, 4324 Old Register Rd, Statesboro, 30460, Georgia, USA. [3]IKERBASQUE, Basque Foundation for Science, Euskadi Pl., 5, Abando, 48009, Bilbao, Spain

diana.rojo@ehu.eus

Salinity changes associated with global change can strongly affect detritus-based stream ecosystems by altering the key process of leaf litter decomposition, which is also known to vary with the identity and diversity of leaf litter. We conducted a controlled microcosm experiment to evaluate the interactive effects of salinity and leaf litter identity and diversity on decomposition mediated by a detritivorous isopod (*Caecidotea* sp.), microbial decomposition, and aquatic hyphomycete sporulation rate and assemblage composition. We used three salinity levels (0, 5 and 10 PSU) and three leaf litter treatments, including monocultures of *Acer rubrum* (a species typical of freshwater ecosystems) and *Spartina alterniflora* (typical of saltwater environments) and their combination. Our results showed an interaction between both factors when decomposition was mediated by detritivores, with higher rates of decomposition of *S. alterniflora* and low salinity and of *A. rubrum* at intermediate salinity. Aquatic hyphomycetes sporulation rate was also affected by our treatments, being higher for *S. alterniflora* and lower for *A. rubrum*. Low salinity promoted an increase in aquatic hyphomycetes; however, further increases in salinity inhibited this effect. Our study provides insights into how concomitant changes in environmental conditions and riparian vegetation can influence stream ecosystem functioning.

Microplastic distribution, morphology and ecological risks in two central Portuguese rivers

Sarra Ben Tanfous[1]*, Abhishek Mandal[2], Juliana Barros[1], Gopala Krishna Darbha[2,3], Seena Sahadevan[1]

[1]University of Coimbra, MARE – Marine and Environmental Sciences Centre, Department of Life Sciences, 3004-517 Coimbra, Portugal. [2]Environmental Nanoscience Laboratory, Department of Earth Sciences, Indian Institute of Science Education and Research Kolkata, Mohanpur 741246, West Bengal, India. [3]Centre for Climate and Environmental Studies, Indian Institute of Science Education and Research Kolkata, Mohanpur 741246, West Bengal, India.

sarrabentanfous05@gmail.com

Microplastics (MPs; 1–5,000 μm) are an emerging environmental concern due to their persistence, ubiquity, and potential ecological risks in aquatic ecosystems. While marine environments have been widely investigated, riverine systems remain comparatively understudied, despite their key role as transport pathways to the ocean. This study evaluates the occurrence, characteristics, and ecological risks of MPs in the upper water column of Mondego and Vouga rivers, two major river systems in Central Portugal. MPs were detected at all sampling sites with concentrations ranging from 150 items m^{-3} to over 500 items m^{-3}, confirming widespread contamination in both rivers. Morphological characterization revealed four color categories, with black particles predominating (> 50%). Five size classes were identified, with sub-millimeter MPs representing the dominant fraction (> 60%). Three morphological forms were observed, with fibers accounting for more than 85% of particles, suggesting significant inputs from textile and urban sources. Polymer analysis identified five polymer types, predominantly polypropylene (≥45%) and polyethylene (≥25%), reflecting common consumer and industrial plastic usage. Ecological risk was assessed using the Pollution Load Index, Polymer Hazard Index and Potential Ecological Risk Index. Despite moderate MP concentrations, the elevated hazard scores of certain polymers classified sections of both rivers within the “danger” and “extreme danger” categories. These findings highlight the ecological vulnerability of Portuguese river systems to microplastic contamination and emphasize the need for integrated monitoring programs, source-control strategies, and strengthened regulatory measures to mitigate freshwater MP pollution.

Emerging contaminants in freshwater ecosystems: the potential of Multi-Omics to reveal impacts and mechanisms

Arunava Pradhan, Cláudia Pascoal, Fernanda Cássio*

Center of Molecular and Environmental Biology (CBMA), Department of Biology, University of Minho, Campus of Gualtar, 4710-057, Braga, Portugal

fcassio@bio.uminho.pt

Emerging contaminants are a diverse group of largely unregulated pollutants whose concentrations in the environment are steadily increasing. These substances—including pharmaceuticals, microplastics, personal care products, endocrine-disruptors, and various industrial chemicals—can enter aquatic environments through multiple pathways, such as agricultural runoff and discharges from wastewater treatment plants. Once released, they may persist in the environment and accumulate along the food chain, posing potential risks to ecosystems and human health. In this presentation, we will discuss this issue using results from Multi-Omics approaches to better understand the biological and ecological effects of these contaminants. We will also highlight that addressing emerging contaminant pollution requires coordinated global action involving producers, consumers, policymakers, and the broader public.

Integrating behavioral biomarkers into ecotoxicology: pharmaceutical pollution induced changes on escape behavior and vulnerability

Ana del Arco[1]*, Nuria de Castro[2], María Cárdenas[2], Gema Parra[1,2]

[1]Centro de Estudios Avanzados en Ciencias de la Tierra, Energía y Medio Ambiente, Campus de Las Lagunillas S/n, E-23071 Jaén, Spain. [2]Departamento de Biología Animal, Biología Vegetal y Ecología, Universidad de Jaén, Campus de Las Lagunillas S/n, E-23071, Jaén, Spain.

aarco@ujaen.es

An increasing body of evidence indicates that pharmaceutical products, even at microconcentrations, have significant impacts on aquatic communities in natural waters driving biodiversity losses. Standard ecotoxicological assessments of chemical stressors in aquatic organisms are commonly based on survival endpoints, potentially overlooking sublethal effects that may arise at low exposure concentrations, inducing vulnerability and altering organisms' behavior. In this context, behavioral endpoints help to fill the knowledge gap regarding how low chemical concentration shape populations spatial distribution and compromise responses to further stressors (i.e., food scarcity, other chemical stressors). Specifically, testing the organisms' ability to escape from contaminated areas can provide insights about changes in local biodiversity. To address this knowledge gap, we assessed whether exposure to relevant concentrations of sulfamethoxazole (0 mg/L, 0.001 mg/L, 0.01 mg/L, 0.1 mg/L and 1 mg/L) and of tramadol (0 mg/L, 0.002 mg/L, 0.02 mg/L, 0.2 mg/L and 2 mg/L) on *Daphnia magna* population impaired its ability to avoid contaminated areas and its resistance to starvation. Our preliminary results with sulfamethoxazole show that *D. magna* scape behavior is diminish from an exposure of 0.01 mg/L which is a concentration found in natural waters. We advocate for a deeper understanding of how organisms' behavioral changes driven by pollution affect population spatial distribution patterns and ultimately its implications at the community level. This could contribute to the inclusion of behavior biomarkers in the risk assessment process.

Pesticides in European ponds: risk assessment and environmental drivers

Daniel Diaz-de-Quijano[1,2,3]*, Julio C. López-Doval[4], Àngels Leiva-Presa[1], Jordi Villà-Freixa[5,6], Aurélie Boissezon[7], Thomas Mehner[8], Sandra Brucet[1,9], Mireia Bartrons[1]

[1]Aquatic Ecology Research Group, Department of Biosciences, Universitat de Vic – Universitat Central de Catalunya, 08500, Vic. [2]Department of Evolutionary Biology, Ecology and Environmental Sciences, Universitat de Barcelona, 08028, Barcelona. [3]Siberian Federal University, 660041, Krasnoyarsk. [4]Applied Ecology and Global Change Unit, Centre Tecnològic BETA – Universitat de Vic, 08500, Vic. [5]Bioinformatics and Bioimaging Research Group, Department of Biosciences, Universitat de Vic – Universitat Central de Catalunya, 08500, Vic. [6]Institut de Recerca en Ciències de la Salut i de la Vida a la Catalunya Central (IRIS-CC), 08500, Vic. [7]HEPIA, HES-SO, University of Applied Sciences and Arts Western Switzerland, 1254, Jussy-Geneva. [8]Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB), 12587, Berlin. [9]Catalan Institution for Research and Advanced Studies, ICREA, Barcelona

daniel.diazdequijano@uvic.cat

Pesticide pollution thresholds for lakes, reservoirs, and rivers are established under the European Water Framework Directive. However, small ponds are not covered by this regulation. This lack of criteria to determine the ecotoxicological risk status of ponds hampers proper assessment and management. In this study, we analyse pesticide concentrations in the waters of 74 European ponds across seven pondscapes in three countries. Since no Environmental Quality Standards for determining ecological and chemical status of these water bodies are defined, we propose the use of toxic units (TU) as an evidence-based criterion to assess the ecotoxicological risk of ponds in the absence of specific legal regulation. Different criteria based on scientific literature have been used. Our results show that the way TU are calculated can dramatically affect conclusions about ecotoxicological risk in ponds. Depending on the assessment factor (AF) used to calculate toxic units, the number of ponds determined to be under ecotoxicological risk would span from 0 to 14 ponds out of 74. In addition, a wide range of environmental variables —including morphological, limnological, climatic and land-use variables— were explored to identify patterns of pesticide pollution in ponds and to provide insights for their management. Overall, pesticide load was higher in ponds with steep littoral, weirs made out of soil and increasing percentages of improved grasslands around it ($p\text{-}v < 0.05$). Pesticide composition was very much linked to livestock grazing and land use parameters like woodlands, arable and improved grasslands covers. In conclusion, the use of TU to assess pond ecotoxicological risk was sensitive enough and has a clear potential but needs further discussion on the AF to be used. On the other hand, our results could not suggest any pond pesticide management policy other than land use management.

Species-specific responses of resting rotifer egg to mercury: Hatching success, embryonic mortality and phenological shifts

Sandra Elices-Sierra[1,2]*, Carmen Pérez-Martínez[1,2], Eloísa Ramos-Rodríguez[1,2]

[1]Institute of Water Research, University of Granada, 18071 Granada, Spain. [2]Department of Ecology, University of Granada, 18071 Granada, Spain

selicess@go.ugr.es

The assessment of zooplankton dormant egg banks is becoming an established practice in aquatic ecotoxicology. In permanent wetlands, these propagules are essential for ensuring the survival of the population during toxicological stress events caused by deteriorating water quality and chemical pollution. This study evaluates the impact of mercury (Hg) on the hatching success, the probability of embryonic abortion and the hatching phenology of resting eggs from two rotifer species*: Brachionus quadridentatus* and *Brachionus plicatilis* (L-morphotype). Both species coexist in Laguna Honda, a coastal wetland in the Albufera de Adra (Almería, Spain), which is under intense anthropogenic pressure from surrounding greenhouse agriculture. A randomized factorial experimental design was used to expose resting eggs, which were isolated from surface sediment, to a control and a gradient of five Hg concentrations ranging from 8 to 400 µg/L for 21 days. Results showed that Hg concentration significantly affected hatching success, with a clear dose-dependent reduction in neonate emergence. However, the species-toxicant interaction was not significant, indicating that Hg negatively impacted hatching success across both species in a consistent manner. Regarding abortion rates, while there was no generalized main effect of Hg, a significant species-Hg interaction was observed. Specifically, increasing Hg concentrations elevated abortion rates in *B. plicatilis*, whereas *B. quadridentatus* maintained stable abortion rates across the toxicant gradient. This reveals that the species' response to the metal is not uniform, pointing towards a higher embryonic vulnerability to Hg in *B. plicatilis*. Hatching day was also shaped by a significant species-Hg interaction. High Hg concentrations triggered earlier hatching in *B. quadridentatus*, whereas no effect was observed in *B. plicatilis*. This differential phenological shift highlights the species-specific nature of Hg impacts on dormant egg banks.

Physiological responses of *Ostrea edulis* to eutrophication and pollution: implications for bioremediation in the Mar Menor lagoon

Jose V. Garaizar[1]*, Maitane Pérez-Cebrecos[1,2], Alatzne Carlosena[3], Kristina Arranz[1], Leire Méndez-Fernández[1], Iñaki Urrutxurtu[1], Maite Martínez-Madrid[1], Marina Albentosa[4], Irrintzi Ibarrola[1]

[1]Physiotox research group. Dept. Genetics, Physical Anthropology and Animal Physiology, Fac. Science and Technology, University of the Basque Country EHU, 48940, Leioa- Bizkaia, Basque Country, Spain. [2]Research Centre for Experimental Marine Biology and Biotechnology (PiE-EHU), University of the Basque Country EHU, 48620, Plentzia-Bizkaia, Basque Country, Spain. [3]Universidade da Coruña, Grupo Química Analítica Aplicada (QANAP), Instituto Universitario de Medio Ambiente (IUMA), Centro de Innovación Tecnológica en Edificación e Ingeniería Civil (CITEEC), 15001, A Coruña, Spain. [4]Centro Oceanográfico de Murcia, Instituto Español de Oceanografía (IEO-CSIC), C/Varadero C1, San Pedro del Pinatar, Murcia, 30740, Spain.

jgaraizar003@ikasle.ehu.eus

This study is part of the MIToYSTER project, which aims to evaluate the European flat oyster (*Ostrea edulis*) as a nature-based solution for restoring the Mar Menor coastal lagoon (Murcia, southeast Spain), a system that is highly eutrophicated, polluted, and ecologically degraded. The aim of the study was to assess how eutrophication and pollution affect the clearance rate (CR) of *O. edulis*, a physiological parameter reflecting individual filtering capacity. This capacity is critical for determining the species' potential as an ecosystem service in the lagoon, as it may help mitigate eutrophication and pollution. Two acute exposure experiments (72 h) were conducted using adult oysters of uniform size (11.08 ± 1.45 g). The first experiment tested increasing concentrations of the microalga Isochrysis galbana (Control: 30,000 part·mL^{-1}; E1: 100,000 part·mL^{-1}; E2: 200,000 part·mL^{-1}; E3: 300,000 part·mL^{-1}; E4: 400,000 part·mL^{-1}). The second experiment involved exposure to different levels (Control, P2, P4, P5, P7) of a pollutant mixture (POLMIX), including tributyl phosphate, dibutyl phthalate, nonylphenol, citalopram, lead, and arsenic. Results showed that CR decreased significantly with increasing phytoplankton concentration, dropping from 1.03 ± 0.48 L·h^{-1} in the control to 0.09 ± 0.05 L·h^{-1} in E4. A similar pattern was observed in the POLMIX experiment, with CR falling from 0.66 ± 0.18 L·h^{-1} in the control to 0.00 L·h^{-1} in P7. Furthermore, while 100% of oysters were active in the control group, activity decreased by more than 80% from P2 to P5 and was completely absent in P7. These results indicate that *O. edulis* retains some bioremediation capacity under moderate eutrophication (up to 300,000 part·mL^{-1}). However, even the lowest POLMIX concentration tested (P2) reduces CR and activity to levels that render bioremediation ineffective, at least during 72 hours of exposure.

Combined effects of urban stressors on freshwater communities: light pollution and urban runoff assessed in indoor artificial streams

Julene González[1]*, Maite Arroita[1], Diana Campos[2], Arturo Elosegi[1], Ana L. Machado[2], João L. T. Pestana[2]

[1]Department of Plant Biology and Ecology, University of the Basque Country (EHU), Barrio Sarriena s/n 48940 Santsoena, Leioa, Spain. [2]CESAM & Department of Biology, University of Aveiro, Campus Universitário de Santiago 3810-193, Aveiro, Portugal

julene.gonzalez@ehu.eus

Urban stream ecosystems are exposed to multiple anthropogenic disturbances that may interact in non-additive ways. Among them, stormwater runoff discharges and artificial light at night (ALAN) are increasingly prevalent but have not been studied in combination. We conducted a 21-day mesocosm experiment to assess how runoff and ALAN jointly influence benthic communities and ecosystem processes. Biofilm-colonized tiles and benthic macroinvertebrate communities were exposed to a factorial combination of urban runoff (0% and 40% of runoff) and different ALAN conditions (0 and 20 lux during nighttime). Effects of runoff, ALAN and their combination were evaluated in terms of macroinvertebrate abundance and diversity, insect emergence, leaf litter processing, primary production and biofilm consumption and growth. We found no difference in invertebrate community diversity but detected a reduction in insect emergence when exposed to runoff water. The response was taxa-dependent under the influence of ALAN, which led to either mitigation or aggravation of the runoff effect. Runoff reduced biofilm growth, while ALAN reduced both growth and chlorophyll content. Runoff increased gross and net primary production, but when combined with ALAN the effect disappeared. Our results demonstrate that stormwater runoff and ALAN interact to alter both community dynamics and ecosystem functioning in urban streams, showcasing the complexity of the response of ecosystems to multiple stressors.

Aquatic community response to the antibiotic ciprofloxacin in Mediterranean wetlands: a mesocosm experiment

Daniel Grillo-Avila[1]*, María Antón-Pardo[1], Javier Armengol[1], Eric Puche[1], Jesús Moratalla-López[1], José Francisco Palacios-Abella[1], Isabel López-Heras[2], Carlos Rochera[1], Antonio Picazo[1], Antonio Camacho[1], Andreu Rico[1]

[1]Institut Cavanilles de Biodiversitat i Biologia Evolutiva, Universitat de València, C/ Catedràtic José Beltrán Martinez 2, 46980 Paterna (València), Spain. [2]IMDEA Water Institute, Av/ Punto Com, 2, Parque Científico Tecnológico de la Universidad de Alcalá 28805, Alcalá de Henares, Spain.

Daniel.Grillo@uv.es

The rapid growth of urban areas and their human populations has led to an increase in the release of pharmaceutical pollutants in natural environments in recent years. Antibiotics, particularly fluoroquinolones such as ciprofloxacin, have been extensively used in human and veterinary medicine over the last few decades to treat a wide range of bacterial infections. This intensive use results in a significant proportion of unmetabolized antibiotics being excreted and reaching wastewater treatment plants, and ultimately, rivers, lakes, and wetlands. This study evaluates the long-term impact of the antibiotic ciprofloxacin on aquatic communities in Mediterranean wetlands for 90 days. Ciprofloxacin was added three times a week for 4 weeks (Control: 0 µg/L; Low concentration: 1 µg/L; Medium: 10 µg/L; High: 100 µg/L) in mesocosms representing two ecological conditions: vegetated (M, containing *Myriophyllum spicatum*) and non-vegetated (NM) wetlands. After 30 days (D30), shifts in microbial community composition were observed in both water and sediment, with a No Observed Effect Concentration (NOEC) of 10 µg/L. These changes coincided with a slight reduction in organic matter decomposition at the highest concentration. Furthermore, an increase in zooplankton abundance was observed at day 60 driven by copepods; this effect was observed at lower concentrations (NOEC = 1 µg/L), suggesting indirect trophic effects likely mediated by microbial and phytoplankton community alterations. Overall, these preliminary results indicate that ciprofloxacin can induce structural changes at multiple trophic levels in Mediterranean wetlands. Despite these concentrations are lower than those found in these ecosystems, they are comparable to concentrations found in other surface waters around the world. These results highlight the possibility of cascading ecological effects and underscore the importance of incorporating community-level responses into environmental risk assessments.

Environmental Risk Assessment of urban stormwater runoff

Itxaso Martinez-Sanz[1]*, Maite Arroita[2], Neus Besolí-Mestres[3,4], M. Isabel Cadena-Aizaga[3], Núria de Castro-Català[1], Ioar de Guzmán[2,5], Karel de Schamphelaere[6], Arturo Elosegi[2], Anna Freixa[3], Julene González[2], Aitor Larrañaga[2], Margarita Menéndez[1], Mira Petrovic[3,7], Sergi Sabater[3,4], Franz Marius Schmitt[6], Qiyun Zhang[6], Isabel Muñoz[1]

[1]Department of Evolutionary Biology, Ecology and Environmental Sciences, Universitat de Barcelona, Av. Diagonal, 643, 08028 Barcelona, Spain. [2]Department of Plant Biology and Ecology, Faculty of Science and Technology, University of the Basque Country EHU, Barrio Sarriena s/n, 48940, Leioa, Spain. [3]Catalan Institute for Water Research (ICRA- CERCA), Carrer Emili Grahit 101, Parc Científic i Tecnològic de la Universitat de Girona, 17003 Girona, Spain. [4]University of Girona, Plaça de Sant Domènec 3, 17004 Girona, Spain. [5]Ecologie comportementale Et Biologie Des Populations de Poissons, French National Research Institute for Agriculture, Food and Environment, 64310, St. Pee sur Nivelle, France. [6]GhEnToxLab, Department of Animal Sciences and Aquatic Ecology, Ghent University, Ghent, Belgium. [7]Catalan Institution for Research and Advanced Studies (ICREA), Barcelona, Spain

itxaso_martinez@ub.edu

Urban stormwater runoff is a significant source of pollution in freshwater ecosystems, as it transports complex loads of organic and inorganic contaminants derived from the wash-off of urban surfaces and from atmospheric deposition. Under climate change, this problem is expected to intensify, as long dry periods followed by intense storms and heavy rainfalls will become more frequent, generating more intense runoff events. However, the occurrence of these contaminants in these waters and the associated environmental risks remain poorly understood. This study aimed to conduct an environmental risk assessment (ERA) of urban runoff to identify the most common compounds and to prioritize them, based on their frequency of detection and their occurrence at risk-relevant concentrations. We analysed organic compounds and metals in urban runoff samples from seven rainfall events across three Spanish cities (San Sebastian, Girona and Viladecans). Rainfall events ranged from 2.5 to 16.6 mm and occurred during winter and spring of 2023 and 2024. We assembled predicted no-effect concentrations (PNECs) of the compounds in order to evaluate the ecological risk of the mixture and calculated the Risk Quotients (RQs) of each compound in the sample. Then, following the concentration addition model (CA), Risk Quotient of the mixture was calculated (RQmix). Preliminary results indicate that all runoff samples had an elevated environmental risk (RQmix ≥ 1). Among organic compounds, the tyre-related compounds 1,3-diphenylguanidine (DPG) and N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine (6PPD) were detected in most samples (100% and 79.4%, respectively). Indeed, when present, both substances exceeded their PNECs in most cases (DPG: 91.2% and 6PPD: 100%). Additionally, the fungicide carbendazim was also found in 47% of samples, and 75% of detections exceeded risk thresholds (RQ ≥ 1). Overall, our results underline that urban runoff represents a significant and currently underestimated source of pollutants, potentially posing an ecological risk to the natural receiving freshwater ecosystems.

Influence of the definition of ecological status boundaries on metal biota quality standards

Leire Méndez-Fernández[1]*, Iñigo Moreno-Ocio[2], Maite Martínez-Madrid[1], Pilar Rodriguez[2]

[1]Department of Department of Genetics, Physical Anthropology, and Animal Physiology, Faculty of Science and Technology, University of the Basque Country EHU, Sarriena S/N, 48940 Leioa, Bizkaia, Spain. [2]Dpt. Zoology and Animal Cell Biology. University of the Basque Country EHU, Sarriena S/N, 48940 Leioa, Bizkaia, Spain.

leire.mendez@ehu.eus

The estimation of Biota Quality Standards demanded by the Water Framework Directive in order to protect aquatic communities from long-term metal pollution can be achieved by using different methodologies. In recent years, the use of non-linear regression models built with data on tissue residues against the ecological quality ratio (EQR) of the field macroinvertebrate communities have permitted to estimate effective tissue residues (ER) in macroinvertebrate taxa related with a Good ecological status of the field community. In this paper we aim to evaluate the possible effect that a recently proposed change of the EQR boundary may have on the estimation of ER levels for As, Cu, Hg and Se. ER values were calculated by a tissue residue approach using the recently proposed ecological quality ratio (EQR) boundary to protect the macroinvertebrate assemblages from the biodiversity loss in rivers of northern Spain, and we compared them with the official boundaries approved in the Spanish legislation. Hazard concentrations (HC) of As, Cu and Hg chemicals were calculated from Species Sensitivity Distribution models using the chemical ER as the predictor variable. Tissue HC were interpreted as threshold tissue concentrations above which there is an increasing probability of alteration of the field macroinvertebrate assemblages, resulting in changes from Good to Moderate Ecological Status. Differences between HC threshold values calculated using the official EQR boundary for Good Ecological Status and the recently proposed boundary were not significant. Species Sensitivity Distribution models have also provided additional information to select the best biomonitors for specific chemicals. For instance, Baetidae and Hydropsychidae can be selected as suitable biomonitors for As, or the predator Rhyacophilidae was selected as the most suitable biomonitor for Hg.

Tasa de aclaramiento y bioacumulación de arsénico y plomo de *Ostrea edulis*: caso de estudio del Mar Menor

Alejandro Mediavilla[1], Sergio Yago Otero[1]*, Kristina Arranz[1], Iñaki Pipaón[1], Maite Martínez-Madrid[1], Iñaki Urutxurtu[1], Pamela Ruiz[2,3], Irrintzi Ibarrola[1], Leire Méndez-Fernández[1]

[1]Dpto. Genética, Antropología Física y Fisiología Animal. Facultad de Ciencia y Tecnología, University of the Basque Country EHU, 48940, Leioa, España. [2]Dpto. Zoología y Biología Celular Animal. Facultad de Ciencia y Tecnología, University of the Basque Country EHU, 48940, Leioa, España. [3]Centro de Investigación de Biología y Biotecnología Marinas Experimentales (PiE-EHU). 48620, Plentzia, España.

sergioyago.otero@ehu.eus

El Mar Menor, laguna costera hipersalina única en Europa, ha sufrido en las últimas décadas una degradación impulsada por la actividad minera y la eutrofización recurrente, lo que exige estrategias eficaces de biorremediación en sistemas lagunares. En este contexto, la ostra plana *Ostrea edulis* destaca como organismo de interés, por su elevada capacidad filtradora, resistencia a contaminantes y condición de especie nativa. En este estudio se evaluaron los efectos agudos (72 h) de dos metales pesados habituales en el Mar Menor, arsénico (5–300 µg As L^{-1}) y plomo (10–200 µg Pb L^{-1}), sobre la fisiología de *O. edulis*, analizando la tasa de aclaramiento y la bioacumulación tisular de ambos metales. No se detectó ninguna tendencia en el porcentaje de actividad filtradora en función de la concentración de metales. Del mismo modo, la tasa de aclaramiento (estandarizada a 0,158 g de peso seco) no varió significativamente entre tratamientos: para As fue de 1,17 ± 0,28 L h^{-1} (control) y 1,2 ± 0,55 L h^{-1} (300 µg L^{-1}); para Pb, de 1,38 ± 0,22 L h^{-1} (control) y 1,67 ± 0,55 L h^{-1} (200 µg L^{-1}). Por su parte, las ostras bioacumularon ambos metales de manera creciente con la dosis. El As varió de 9,75 ± 0,47 µg g^{-1} en los controles a 11,62 ± 1,05 µg g^{-1} en el tratamiento más alto. El Pb varió de 0,35 ± 0,09 µg g^{-1} a 102,36 ± 11,59 µg g^{-1} , acumulando de manera proporcional a la concentración ambiental. En conjunto, los resultados respaldan el potencial de esta especie como agente biorremediador a corto plazo en ambientes costeros contaminados por metales pesados. No obstante, se requieren estudios adicionales que evalúen los efectos crónicos y la viabilidad ecológica de su aplicación a largo plazo.

Chitosan membranes may mitigate the effects of ciprofloxacin and silver nanoparticles in freshwater ecosystems

Nuno Faria, Cláudia Pascoal*, Pedro Martins, Arunava Pradhan

Center of Molecular and Environmental Biology (CBMA), Department of Biology, University of Minho, Campus of Gualtar, 4710-057, Braga, Portugal

cpascoal@bio.uminho.pt

Freshwater ecosystems are among the most biodiverse environments, yet they are increasingly threatened by emerging contaminants such as antibiotics and engineered nanoparticles. Emerging contaminants like ciprofloxacin (CIP) and silver nanoparticles (Ag-NPs) frequently enter aquatic systems through wastewater discharges due to improper management and inefficient removal during wastewater treatment processes, making freshwater ecosystems likely final environmental sinks. Understanding the ecological consequences of these contaminants requires evaluating their effects on key ecosystem processes, such as organic matter decomposition, and the microbial communities that drive those processes. Aquatic hyphomycetes are the primary microbial decomposers of allochthonous plant litter in lotic ecosystems and are sensitive to several contaminants, making them potential bioindicators of freshwater ecosystem disturbance. The objective of this study was to evaluate the effectiveness of eco-sustainable chitosan membranes in removing ciprofloxacin and silver nanoparticles from contaminated water and to assess whether this treatment can mitigate their effects on aquatic fungal communities and plant litter decomposition. To achieve this, the effects of CIP and Ag-NPs, individually and in mixtures, either untreated or treated with chitosan membranes, were assessed on plant litter decomposition, fungal reproduction (sporulation), and antioxidant enzyme activity in microcosms. Chitosan membranes effectively removed both contaminants, including when present in mixtures. Exposure to untreated contaminants significantly reduced fungal sporulation, particularly under Ag-NP and mixture treatments. Plant litter decomposition was not significantly affected. Antioxidant enzyme activities, including glutathione peroxidase and glutathione reductase, increased in fungal communities exposed to untreated CIP and/or Ag-NPs, indicating induced oxidative stress. These responses were attenuated in microcosms exposed to contaminant solutions previously treated with chitosan membranes. Overall, our results indicate that CIP and Ag-NPs may pose risks to aquatic fungal communities and the ecosystem functions they support. However, eco-sustainable chitosan membranes show promise as nature-based remediation tools to mitigate the impacts of emerging contaminants in freshwater ecosystems.

Comparative effects of the fungicide tebuconazole on aquatic ecosystems in three climatic regions: a metacosm approach

Carlos Pascual-March[1]*, José Francisco Palacios[1], Maria Bisquert[1], Marcela Cabrera[2], Mirian Lapo[2], Hugo Shiguango[2], Jose Luís Rodríguez-Gil[3,4], Bradley Park[3], Mark Hanson[4], Alistair Brown[5], Andreu Rico[1]

[1]Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, C/ Catedrático José, Beltrán 2, 46980, Paterna, Valencia, Spain. [2]Grupo de Investigación de Recursos Hídricos y Acuáticos, Universidad Regional Amazónica Ikiam, Tena 150150, Ecuador. [3]IISD-Experimental Lakes Area, Winnipeg, Manitoba, Canada. [4]Department of Environment and Geography, University of Manitoba, Winnipeg, Manitoba, Canada. [5]Department of Soil Science, University of Manitoba, Winnipeg, Manitoba, Canada

carlos.pascual-march@uv.es

Chemical pollution is recognized as one of the greatest threats to aquatic biodiversity globally. However, current approaches to assessing its risks in freshwater ecosystems depend primarily on toxicity data from a limited number of model organisms native to temperate regions. As a result, the broader impacts on aquatic communities in other climatic zones remain largely unknown. This study aimed to investigate how climatic conditions and ecological interactions shape the ecotoxicological effects of chemicals on aquatic ecosystems. A replicated mesocosm study (metacosm) with the fungicide tebuconazole was conducted in three different bioclimatic regions: temperate-cold (Canada), mediterranean (Spain) and tropical (Ecuador). Tebuconazole was applied at four concentrations (i.e., 70, 200, 700, 2000 µg/L) in the different locations using freshwater mesocosms inoculated with local aquatic communities. The effects were assessed on physicochemical variables, chlorophyll-a, phytoplankton, zooplankton, macroinvertebrates, macrophytes and decomposition. Tebuconazole dissipated faster in Ecuador and Canada (DT50: 41±7, 32±5 days, respectively) than in Spain (DT50: 69±14 days). It caused a decrease in oxygen and pH in Spain and Canada at the highest test concentration 2000 µg/L, and reduced organic matter decomposition (NOEC: 70 µg/L). However, none of these effects occurred in Ecuador. In Spain, an increase in chlorophyll-a and macrophyte mortality occurred at 2000 µg/L. The macroinvertebrate community exhibited high sensitivity, with NOEC values below 70 µg/L for certain species—most notably the gastropods *Physella acuta* (NOEC <70 µg/L in Spain, compared to 200 µg/L in Canada) and Planorbidae (NOEC: 70 µg/L in Canada). The Principal Response Curve analysis further revealed that the macroinvertebrate community had not recovered by Day 70, whereas the zooplankton community showed signs of recovery by Day 56 in Spain. This study shows that the effects of chemical pollution are context specific and highlights notable differences in sensitivity and resilience of freshwater taxonomic groups across different bioclimatic regions.

Physiological resilience of the native oyster *Ostrea edulis* under eutrophication and pollution scenarios: implications for restoration of the Mar Menor lagoon

Maitane Pérez-Cebrecos[1,2]*, Sergio Yago Otero[1], Silvia Sañudo[1], Inés Cano[1], Alatzne Carlosena[3], Kristina Arranz[1], Iker Bilbao[1], Leire Méndez-Fernández[1], Iñaki Urrutxurtu[1], Maite Martínez- Madrid[1], Marina Albentosa[4], Irrintzi Ibarrola[1]

[1]Physiotox research group. Dept. Genetics, Physical Anthropology and Animal Physiology, Fac. Science and Technology, University of the Basque Country EHU, 48940, Leioa- Bizkaia, Basque Country, Spain. [2]Research Centre for Experimental Marine Biology and Biotechnology (PiE-EHU), University of the Basque Country EHU, 48620, Plentzia-Bizkaia, Basque Country, Spain. [3]Universidade da Coruña, Grupo Química Analítica Aplicada (QANAP), Instituto Universitario de Medio Ambiente (IUMA), Centro de Innovación Tecnológica en Edificación e Ingeniería Civil (CITEEC), 15001, A Coruña, Spain. [4]Centro Oceanográfico de Murcia, Instituto Español de Oceanografía (IEO-CSIC), C/ Varadero C1, San Pedro del Pinatar, Murcia, 30740, Spain

maitane.perez@ehu.eus

The Mar Menor coastal lagoon (SE Spain) has undergone severe eutrophication and chronic chemical contamination, leading to ecosystem degradation and the disappearance of the native flat oyster *Ostrea edulis*. As a suspension feeder, *O. edulis* historically contributed to water filtration and ecosystem functioning. Determining whether this species can withstand current environmental conditions is critical to assess its restoration potential. Two 21-day laboratory experiments were conducted to examine acute (3 days) and chronic (21 days) bioenergetic responses of juvenile oysters to increasing eutrophication levels (E1: 100,000 part·ml^{-1}; E2: 200,000 part·ml^{-1}; E3: 300,000 part·ml^{-1}), alone and combined with an environmentally realistic pollutant mixture (POLMIX) representative of Mar Menor contamination (Tributyl phosphate, dibutyl phthalate, nonylphenol, citalopram, arsenic and lead). Water chemistry was monitored throughout the experiment. Clearance rate, absorption efficiency, absorption rate, routine metabolic rate, and scope for growth (SFG) were measured, and bioaccumulation quantified after 3 and 21 days. Under eutrophication alone, SFG increased from day 3 to day 21, particularly under control and moderate eutrophication (E1), indicating physiological acclimation. At higher eutrophication levels (E2–E3), SFG remained low but did not become negative. Under combined stressors, early reductions in feeding parameters were observed, yet SFG values improved over time and remained non-negative across treatments. Bioaccumulation analyses revealed selective uptake of tributyl phosphate, nonylphenol and citalopram of exposed treatments after 3 and 21 days. Our results demonstrate that *O. edulis* can survive, maintain positive or near-zero energy balance, and sustain filtration capacity under realistic eutrophication and pollution scenarios. Although high nutrient loads constrained growth, energetic maintenance was preserved. These findings position the native flat oyster as a resilient and ecologically relevant candidate for ecosystem-based restoration and bioremediation strategies in the Mar Menor.

When conventional fungicides meet nanofungicides: ecotoxicological impacts in a bi-trophic (host-parasite) aquatic model

Ana Rita Pimentão[1,2]*, Cláudia Pascoal[1,2], Fernanda Cássio[1,2], Bruno B. Castro[1,2]

[1]Centre of Molecular and Environmental Biology (CBMA) / Aquatic Research Network (ARNET), Department of Biology, University of Minho, Braga, Portugal. [2]Institute of Science and Innovation for Bio-Sustainability (IB-S), School of Sciences, University of Minho, Braga, Portugal

ritapimentão703@gmail.com

The intensification of agriculture has resulted in a strong dependence on conventional fungicides to control crop diseases and sustain yields. Increasing application rates and repeated use have raised concerns about environmental contamination and adverse effects on non-target organisms, particularly in aquatic ecosystems, prompting the exploration of alternative approaches to improve efficacy while reducing environmental impacts. Nano-fungicides, a new generation of agrochemicals, promise enhanced efficiency in precision agriculture and reduced environmental impact. However, their use alongside conventional fungicides is expected to increase the occurrence of complex chemical mixtures in surface waters, whose ecological consequences remain poorly understood. Using an aquatic bi-trophic model, we investigated the effects of mixtures of conventional fungicides and copper oxide nanoparticles (CuO-NPs) on host-parasite interaction and disease spread. We used *Daphnia magna* as the host and the microparasitic yeast *Metschnikowia bicuspidata* to assess the impacts of two fungicide mixtures: tebuconazole (sterol biosynthesis inhibitor) + CuO-NPs and azoxystrobin (cell respiration inhibitor) + CuO-NPs. Parasite prevalence, parasite spore load, and host mortality were evaluated under single and combined exposures. The two fungicide mixtures altered host-parasite dynamics in distinct ways. The interaction of tebuconazole and CuO-NP was often complex, with each substance differentially affecting host survival and parasite infectivity, whilst the combined exposure modified infection processes and host tolerance to disease. In contrast, effects of the azoxystrobin + CuO-NP mixture were primarily driven by azoxystrobin, but host mortality was alleviated in the presence of any combination of the compounds (isolated or in mixture), due to a protective effect against parasite effects. Overall, our results demonstrate that mixtures of conventional fungicides and nanofungicides can alter aquatic biological processes in substance-specific and context-dependent ways by affecting organism performance and species interactions. These results underscore the importance of evaluating mixture toxicity and emerging pesticide formulations under ecologically realistic conditions that incorporate biotic interactions.

Efecto de la temperatura y la contaminación por plomo sobre la capacidad de biorremediación de la ostra plana *Ostrea edulis*

Iñaki Pipaón[1]*, Sergio Yago Otero[1], Alejandro Mediavilla[1], Markel Montaño-Lekue[2], Pamela Ruiz[2], Maite Martínez- Madrid[1], Kristina Arranz[1], Iñaki Urrutxurtu[1], Irrintzi Ibarrola[1], Leire Méndez-Fernández[1]

[1]Department of Department of Genetics, Physical Anthropology, and Animal Physiology, Faculty of Science and Technology, University of the Basque Country EHU, Sarriena z/g, 48940 Leioa, Bizkaia, Spain. [2]CBET+ Research Group, Department of Zoology and Animal Cell Biology, Faculty of Science and Technology, Research Centre for Experimental Marine Biology and Biotechnology PiE-EHU, University of the Basque Country EHU, Areatza z/g, 48620 Plentzia, Bizkaia, Spain.

ipipaon001@ikasle.ehu.eus

Los ecosistemas acuáticos están sometidos a diferentes fuentes de estrés de origen antrópico, como el aumento de la temperatura a consecuencia del cambio climático o la exposición a contaminantes. Los bivalvos son organismos clave debido a los servicios ecosistémicos que ofrecen, como la mejora de la calidad del agua mediante su actividad filtradora. En este estudio utilizamos una especie nativa como la ostra plana (*Ostrea edulis*) como organismo modelo, utilizada en acciones de biorremediación en la laguna del Mar Menor (Murcia), un ecosistema hipersalino único en Europa. Sin embargo, la toxicidad de los contaminantes y la temperatura del agua puede afectar el potencial de biorremediación que estos organismos ofrecen. Por ello, en el presente estudio se evaluó el efecto de la temperatura y la contaminación del plomo (contaminante habitual en el Mar Menor) sobre la fisiología, la capacidad de bioacumulación de Pb en tejido y las alteraciones histopatológicas de *O. edulis*. Las ostras se expusieron durante 72 h a tres temperaturas (18, 23 y 28 °C), en condiciones control (sin Pb) y dos concentraciones crecientes de Pb en agua (50 y 200 µg L^{-1}). Tras el periodo de exposición se observó una reducción significativa de la tasa de aclaramiento a 28 °C con respecto al control, mientras que el consumo de oxígeno aumentaba significativamente en esta condición. Así mismo, se observó un incremento de la bioacumulación de Pb conforme aumenta la concentración en el medio externo. Sin embargo, no se observó una relación significativa entre la bioacumulación de Pb y el aumento de la temperatura. Por último, se observaron diferentes alteraciones histopatológicas en glándula digestiva, branquias y gónada. En conclusión, el aumento de la temperatura y la exposición al plomo incrementan el estrés en *Ostrea edulis*, pudiendo limitar su eficacia en la biorremediación de ecosistemas a largo plazo.

Unveiling the aftermath: impacts of the 2024 flash flood on organic contaminant risks in the Albufera Natural Park (Valencia, Spain)

Andreu Rico[1]*, Jhesibel Chavez[2], Julian Campo[2], Pere Colomer-Vidal[3], Juan Muñoz-Arnanz[3], Begoña Jiménez[3], Cristiana Rizzi[4], Lorenzo Federico[4], Sara Villa[4], Jose Francisco Palacios[1], Antonio Picazo[1], Carlos Rochera[1], Pablo Amador[1], Antonio Camacho[1]

[1]Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, C/ Catedrático José, Beltrán 2, 46980, Paterna, Valencia, Spain. [2]Environmental and Food Safety Research Group (SAMA-UV). Desertification Research Centre - CIDE (Spanish National Research Council, University of Valencia, Generalitat Valenciana). Carretera CV-315 km 10.7 (Campus IVIA). 46113 Moncada, Valencia, Spain. [3]Department of Instrumental Analysis and Environmental Chemistry, Institute of Organic Chemistry (IQOG-CSIC), Juan de la Cierva 3, Madrid, 28006, Spain. [4]Department of Earth and Environmental Sciences (DISAT), University of Milano-Bicocca, Piazza Della Scienza 1, Milan, 20126, Italy

andreu.rico@uv.es

Floods are increasing in frequency and severity due to climate change, with further intensification expected in the Mediterranean region. On 29 October 2024, an extreme rainfall event triggered a catastrophic flash flood in Spain's Valencia region, causing 230 fatalities. A substantial portion of the floodwaters drained into L'Albufera Natural Park (ANP), Valencia (Spain). The flood transported urban and industrial waste and caused sewage network collapse, creating one of the most significant ecological disturbances in the ANP in recent decades. This study aimed to characterize the pollutant footprint of this extreme event and assess associated ecological risks. Following the flood, water and sediment samples were collected from 15 sites and analyzed for 241 organic contaminants, including pesticides (PEST), pharmaceuticals and personal care products (PPCPs), perfluoroalkyl substances (PFAS), organophosphorus flame retardants (OPFRs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and dioxins and furans (PCDD/Fs). Subsequently, quarterly sampling at 20 sites was conducted, focusing on PEST, PPCPs, PFAS and OPFRs. The flash flood triggered a surge of organic pollutants, particularly PPCPs, OPFRs and PAHs, and caused widespread remobilization of hydrophobic compounds. Water concentrations exceeded pre-event levels by more than 50 times. Although acute lethal effects on aquatic organisms were unlikely, 44 organic pollutants exceeded long-term aquatic toxicity thresholds. Notable exceedances in water included ibuprofen, PFOS, and fluoranthene, while sediments contained 13 high-risk compounds. The highest ecotoxicological risks in water were in the lake and northwestern sector, while sediment risks were more uniform. High risks for substances such as ibuprofen persisted for months after the flood. By July 2025, most flood-related exposure had returned to background conditions, though agricultural pesticide risks increased. This study provides one of the first detailed assessments of an extreme flood's impact on a European protected wetland and describes its long-term ecotoxicological risks and resilience dynamics.

Effects-based assessment of stormwater runoff in Portuguese urban catchments: first results and perspectives from project URBAnWat3r

Sara Rodrigues[1,2]*, Ana Rita Pimentão[1,2], Pedro A. Costa[1,2], Bruno B. Castro[1,2]

[1]CBMA, Centro de Biologia Molecular e Ambiental/Rede de Investigação Aquática (ARNET), Departamento de Biologia, Escola de Ciências da Universidade do Minho, Braga, Portugal. [2]IB-S, Instituto de Ciência e Inovação para a Bio-Sustentabilidade (IB-S), Escola de Ciências da Universidade do Minho, Braga, Portugal

sara.rodrigues@bio.uminho.pt

Urbanization and inadequate stormwater management are increasing pressures on (sub)urban rivers, exacerbating pollutant loads, habitat degradation, and biodiversity loss. Despite their ecological and social relevance, stormwater impacts on receiving waterbodies remain poorly characterized. Project URBAnWat3r addresses this gap by assessing how (sub)urban stormwater runoff affects water quality and ecosystem health in three pilot urban catchments: Este (Braga), Sousa (Lousada), and Vale das Flores (Coimbra) riverine systems. The project intends to use an effects-based assessment approach using standardized laboratory bioassays to evaluate potential ecological impacts of these inflows. In each pilot area, three sampling locations were selected where water samples were collected from (i) a stormwater outlet discharge point, (ii) an upstream site, and (iii) a downstream site in the receiving ecosystem. Bioassays were conducted with collected water samples using standard freshwater organisms representing different trophic levels and ecological functions (e.g., *Raphidocelis subcapitata*, *Spirodela polyrhiza*, *Daphnia magna*, *Heterocypris incongruens*). By linking this information with contaminant profiles, the project serves the purpose of moving beyond single-line assessments and strengthening the interpretation of cause-and-effect relationships between runoff and ecosystem health. First results revealed spatial variability in pollutant loads and biological effects across sites, with evidence of sublethal and acute responses in bioassays in more urbanized stretches. By identifying hotspots associated with poor stormwater management and diffuse urban pressures, we can provide key information for managers and planners. Effect-based responses provided added sensitivity, highlighting ecological risks not evident from analytical data exclusively. URBAnWat3r aims to establish a harmonized, reproducible framework to assess stormwater-driven ecological risks in urban watersheds. However, there is a need to go beyond that: by using scientific evidence gathered in ecosystems that are closely connected with the community, the project also intends to foster knowledge-based decision-making and citizen engagement toward more sustainable stormwater management practices in (sub)urban landscapes. FUNDING: Project URBAnWat3r (COMPETE2030-FEDER-00707600, https://doi.org/10.54499/2023.17531.ICDT) is supported by European funds, through COMPETE2030, and national funds, through the Portuguese Foundation for Science and Technology (FCT).

Past, present and future perspectives towards a global synthesis of body size scaling relationships under a freshwater world

Ignasi Arranz Urgell

Instituto de Investigación en Cambio Global, Universidad Rey Juan Carlos, Madrid, España

ignasi.arranz@urjc.es

Ecological synthesis research integrates evidence across theoretical, experimental, quantitative and field-based approaches to identify generalities and improve the effectiveness of conservation actions. Body size research has been a core theme over a century since body size is tightly linked to other traits and metabolic demands, and metabolic theory provides baseline expectations for how size-structured communities and food webs should respond to temperature. A growing body of evidence indicates that warming is frequently associated with shifts toward smaller body sizes, a pattern proposed as a major ecological response to climate change in species, communities and food webs. However, temperature effects on body size are rarely persistent in real world contexts since they can be modulated by resource supply, community and trait composition, and interacting anthropogenic pressures, producing context-dependent complexities from simple theoretical predictions. In this talk, I synthesize my work on body size scaling relationships (BSSR) and the resulting size-structured patterns (e.g., size spectra) that shape ecological networks and constrain ecosystem functioning through their effects on energy fluxes and nutrient cycling. I focus on freshwater ecosystems, among the most human-impacted ecosystems exceeding critical planetary boundaries that regulate ecosystem functioning and integration. I present a synthesis framework organized around four complementary axes—experimental, theoretical, quantitative, and field- based—combining biometrics, stable isotopes, metabarcoding, and respirometry. By linking shifts in BSSR to community and food-web organization, I show how BSSR can support biomonitoring and improve forecasts of anthropogenic pressures in the Anthropocene.

Barranquismo en tres espacios naturales protegidos del Pirineo y Prepirineo: comparación de la magnitud del impacto sobre los macroinvertebrados bentónicos

Andrea Bes[1]*, David Guzmán Otano[2], Clara Soler[3], Ada Pastor[3], Rocío López-Flores[1]

[1]Universidad de Zaragoza, Escuela Politécnica Superior de Huesca, Carretera de Cuarte, s/n22071, Huesca, España. [2]Servicio Provincial de Huesca, Departamento de Medio Ambiente y Turismo. Plaza Cervantes, 1, 22071, Huesca, España. [3]Instituto de Ecología Acuática, Universidad de Girona, Campus de Montilivi, M. Aurèlia Capmany, 69, 17003 Girona, España

abes@unizar.es

El barranquismo es un deporte muy practicado en el Pirineo y Prepirineo. Los estudios previos realizados en el Parque Natural de la Sierra y Cañones de Guara (PNSCG) mostraron que esta actividad deportiva tiene un efecto de negativo sobre la comunidad bentónica, reduciendo su abundancia y riqueza. El objetivo de esta investigación fue evaluar si el impacto que el barranquismo ejerce sobre la comunidad de macroinvertebrados es comparable en tres espacios protegidos del noreste de la península ibérica: PNSCG, Parque Nacional de Ordesa y Monte Perdido y Parque Natural de las Cabeceras del Ter y del Freser. Para ello, se recogieron muestras de macroinvertebrados bentónicos en siete barrancos, comparando tramos control (no frecuentados por deportistas) y tramos frecuentados. Los muestreos se realizaron durante la temporada alta de barranquismo (julio-septiembre). Los resultados mostraron que la estructura de la comunidad de referencia, en los tramos control, era distinta en los tres espacios protegidos, debido a las condiciones ambientales características de cada zona (pendiente y precipitaciones). Tras la comparación de las comunidades de los tramos control y frecuentados, se apreció un cambio en la estructura de la comunidad asociado a la frecuentación, representado por una pérdida de abundancia de las familias sensibles y un incremento de esta en los taxones tolerantes. El análisis de los índices taxonómicos y de estado ecológico mostró que la frecuentación implica un descenso de la abundancia total, la riqueza, el índice IBMWP y la abundancia de tricópteros. En el conjunto de los espacios protegidos estudiados, el barranquismo empobreció y alteró la estructura de la comunidad de manera consistente, aunque modulada por el contexto ambiental. Los resultados de este trabajo subrayan la necesidad de gestionar esta actividad deportiva, con el fin de hacer compatible el uso recreativo con la conservación.

Temporal variation in freshwater community structure: insights from distance–decay

Ioar de Guzman[1,2]*, Mathieu Buoro[2], Aitor Larrañaga[1]

[1]Department of Plant Biology and Ecology, University of the Basque Country, Organization, 48940, Leioa, Spain.
[2]Ecologie Comportementale Et Biologie Des Populations de Poissons, French National Research Institute for Agriculture, Food and Environment, 64310, St. Pee sur Nivelle, France

mirenioar.deguzman@ehu.eus

Over the past decades, environmental conditions in freshwater ecosystems in the Global North have substantially improved following the implementation of environmental regulations, resulting in a higher ecological status of streams and rivers. Although recent studies report signs of recovery in aquatic communities, it remains unclear whether these improvements conditions have also restored the large-scale biodiversity patterns that structure natural ecosystems. In natural systems, biodiversity is shaped by spatial and environmental gradients, but human pressures tend to disrupt these relationships. Typically, the similarity of biological communities decrease with increasing geographical distance due to environmental differences among sites and the dispersal limitations of organisms; a biogeographical pattern known as distance decay. Anthropogenic impacts can further alter this pattern and temporal fluctuations in environmental conditions can lead to varying rates of distance decay in community similarity. Here, we aim at understanding the variation of continental scale community structure and composition over the last decades by analyzing the decay in similarity among communities with geographical distance. We hypothesize that communities have become more homogeneous through time, both taxonomically and functionally, due to the improvement of environmental conditions, leading to a shallower decay in similarity over time. For this purpose, we collected publicly available data of fish monitoring surveys from five different European countries for the last 20 years. For each year, we calculated taxonomic and functional distance between communities, as well as geographic distance among sampling sites. We additionally obtained environmental information such as flow connection, climatic region and human footprint index for each site. We used a hierarchical Bayesian model approach to determine how community similarity was associated to the variables of interest and how distance decay changed with time. Preliminary results suggest that the relationship between community similarity and geographic distance has shifted over time, although the effects of human impact are still obvious.

Climate stress and antibiotics: a double hit on freshwater fish health

Bárbara S. Diogo[1,2,3]*, Sara Rodrigues[4,5], Sara C. Antunes[2,3]

[1]ICBAS, Instituto de Ciências Biomédicas de Abel Salazar, Universidade do Porto, Porto, Portugal. [2]CIMAR/CIIMAR, Centro Interdisciplinar de Investigação Marinha e Ambiental, Universidade do Porto, Terminal de Cruzeiros do Porto de Leixões, Matosinhos, Portugal. [3]FCUP, Departamento de Biologia, Faculdade de Ciências, Universidade do Porto, Porto, Portugal. [4]CBMA, Centro de Biologia Molecular e Ambiental/Rede de Investigação Aquática (ARNET), Departamento de Biologia, Escola de Ciências da Universidade do Minho, Braga, Portugal. [5]IB-S, Instituto de Ciência e Inovação para a Biosustentabilidade (IB-S), Escola de Ciências da Universidade do Minho, Braga, Portugal

barbara.diogo@fc.up.pt

Environmental stressors (e.g., temperature and pH fluctuations) can interact with antibiotics in aquatic ecosystems, producing significant effects that differ from single-stressor exposures and underscoring the need for integrated ecotoxicological assessment. This study aimed to evaluate the chronic effects of environmentally relevant concentrations of sulfamethoxazole (150 µg SMX/L), trimethoprim (30 µg TRIM/L), and their mixture (MIX: 150 µg SMX/L + 30 µg TRIM/L) in *Danio rerio* juveniles. Three independent assays were conducted, each representing a different environmental scenario: temperature (26, 28, and 32 °C), pH (6.5, 7.5, and 9.0), and a combined climate-change scenario (28 °C + pH 9.0). Toxicity and impacts on *D. rerio* health status were assessed using a multi-biomarker approach covering antioxidant/biotransformation defenses, cholinergic activity, energy metabolism, and DNA damage. SMX, TRIM, and MIX toxicity were moderately influenced by temperature, but highly shaped by pH. Under acidic conditions, SMX (a weak acid) is expected to remain largely non-ionized, enhancing cellular uptake and causing severe effects (e.g., lipid peroxidation and DNA damage). TRIM toxicity also showed a strong pH-dependent response, consistent with its properties as a weak base. At acidic pH, TRIM primarily affected antioxidant defenses, while at neutral and alkaline pH, it caused lipid peroxidation and neurotoxicity effects. At low pH, MIX showed similar patterns, inducing oxidative stress and lipid peroxidation, and at neutral and alkaline pH, severe effects were observed (e.g., DNA damage). Importantly, under the combined climate-change scenario, the simultaneous increase in temperature and pH intensified the toxicity of both individual antibiotics and MIX. This interactive effect resulted in marked disruptions to antioxidant defenses, energy metabolism, and DNA integrity in *D. rerio*. Overall, these results demonstrate that climate-driven changes in pH and temperature are key modulators of antibiotic toxicity, exacerbating physiological/biochemical impairments, and reinforcing concerns about the escalating ecological risk that antibiotics pose to freshwater ecosystems under future climate conditions.

Revealing the community assembly and ecological niche of endangered Iberian cyprinids in eastern Mediterranean basins: an eDNA and JSDM approach to freshwater conservation

Carmen Duque-Amado[1,2]*, Agustín Monteoliva[1], Silvia Perea[2], Carlos Cano-Barbacil[2], Ignacio Doadrio[2]

[1]Ecohydros S.L. [2]Departamento de Biodiversidad y Biología Evolutiva, Museo Nacional de Ciencias Naturales, CSIC, Madrid 28006, Spain

carmen.duque@mncn.csic.es

Anthropogenic pressures and increasing resource demands have severely degraded Mediterranean freshwater ecosystems, threatening narrow-range endemic taxa. This study focuses on two vulnerable Iberian cyprinids of the genus *Parachondrostoma*: the loina (*P. arrigonis*), endemic to the Júcar basin, and the Turia nase (*P. turiense*), found in the Turia and Mijares basins. Both species have faced dramatic population downfalls (exceeding 80% for *P. arrigonis*), driven by habitat fragmentation, pollution, and the spread of invasive species. To update their current distribution and clear up the mechanisms governing their ecological niche, we have used environmental DNA (eDNA) metabarcoding across 65 sites in the Mijares, Turia, Júcar, and Vinalopó basins. By analyzing the mitochondrial 12S rRNA gene, we confirmed the presence of *Parachondrostoma* in 7 sites for *P. arrigonis* and 12 for *P. turiense*, highlighting a continuous decline in their historical ranges. By integrating climatic and environmental variables with eDNA detection data, we aim to differentiate the effects of abiotic filtering from biotic interactions in shaping the species ecological niche. Our results showed that fish communities associated with these endemics differ significantly. Notably, the eDNA signal of invasive species such as *Esox lucius* or *Micropterus salmoides* was minimal or absent in sites where *Parachondrostoma* persisted. However, we identified the detection for the first time of highly invasive top predator *Silurus glanis* in the Magro River. The joint species distribution model (JSDM) framework allowed us to quantify whether the absence of these endemics in previously occupied areas is driven by climatic unsuitability or by biotic exclusion due to the impact of invasive species. Our findings demonstrate that eDNA is not only a sensitive tool for monitoring biodiversity but, when combined with niche modeling, provides critical insights into the community assembly and the remaining refuges for these endangered endemics in a changing environment.

Forecasting Diptera populations in the riparian zones of European urban streams and human health risks

Maria João Feio[1]*, Ana Raquel Calapez[1], Marcos Dias[1], Ana Cláudia Norte[1], Hugo Osório[2], Janine Pereira da Silva[1], Fernanda Rodrigues[1,3,4], Dirk S. Schmeller[5], Rayan Bouchali[5], Adeline Loyau[5], Peter Goethals[6], Marie Anne Eurie Forio[6], Long Ho6, Anne Moen[7], Silje Havrevold Henni[7], May Linn Bokma Morch[7], Luigi Esposito[8], Nadia Piscopo[8], Akis Karagiannisi[9], Symeon Symeonidis[9], George Koutalieris[9], Sónia RQ Serra[1]

[1]University of Coimbra, MARE/ARNET, Department of Life Sciences, FCTUC, Largo Marquês de Pombal, 3004-517 Coimbra, Portugal. [2]Instituto Nacional de Saúde Doutor Ricardo Jorge (INSA). Centro de Estudos de Vetores e Doenças Infeciosas Doutor Francisco Cambournac (CEVDI), Avenida da Liberdade, 5, 2965- 575 Águas de Moura, Portugal. [3]University of Coimbra, CERES, Department of Chemical Engineering, FCTUC, Rua Sílvio Lima, 3030-790 Coimbra, Portugal. [4]University of Coimbra, INESC Coimbra, Department of Civil Engineering, FCTUC, Rua Luis Reis Santos, 3030-788 Coimbra, Portugal. [5]Université de Toulouse, Centre de Recherche sur la Biodiversité et l´Environnement (CRBE), CNRS, IRD, Toulouse INP, Université Toulouse 3 - Paul Sabatier (UT3), 31062 Toulouse, France. [6]Ghent University, Aquatic Ecology Research Unit, Department of Animal Sciences and Aquatic Ecology, Coupure Links, 653, 9000 Ghent, Belgium. [7]University of Oslo, Institute of Health and Society, Department of Public Health Science, 0318 Oslo, Norway. [8]University of Naples Federico II, Department of Veterinary Medicine and Animal Production, Via F. Delpino, 1, 80137 Naples, Italy. [9]ENORA Innovation, Greece Ploutonos 25, 19200, Eleusis, Greece

mjf@ci.uc.pt

Urban streams are expanding interfaces between freshwater ecosystems and human populations, yet their role in shaping medically relevant Diptera assemblages remains largely unexplored. While mosquito range shifts under climate change are widely modelled, the influence of urban stream integrity and rehabilitation on adult Diptera communities, and their potential One Health implications is poorly understood. We sampled adult Diptera in the riparian zones of 84 urban streams across five European cities (Benevento, Coimbra, Ghent, Oslo, Toulouse) spanning a broad latitudinal gradient. Assemblage composition differed significantly among cities and was structured by hydromorphology, riparian vegetation, water quality and connectivity. Among 35 dipteran groups recorded, seven families include taxa of medical relevance, and 13 species are confirmed disease vectors in Europe, including the invasive mosquito vector *Aedes albopictus*. Using the HYDRA machine-learning framework, we modelled taxon-specific occurrence and simulated rehabilitation and climate change scenarios (2050–2090; SSP126–SSP245–SSP585). Climate-only scenarios produced relatively moderate shifts in assemblage composition. In contrast, stream rehabilitation scenarios, particularly when combining hydromorphological restoration, riparian vegetation renaturalization and water-quality improvement, generated stronger and more consistent changes in predicted vector occurrence. Warm-adapted taxa such as *Aedes albopictus* (dengue, Zika, chikungunya, and yellow-fever vector) and the *Culex pipiens* complex (e.g., vector of the West Nile virus) are projected to expand under higher temperatures, whereas several other medically relevant families (e.g., Ceratopogonidae and Simuliidae) show city-specific responses dependent on local habitat context. Our findings indicate that urban stream integrity constitutes a critical and under-recognized leverage point for influencing Diptera assemblages with potential health implications. Integrating freshwater

ecosystem management within a One Health framework may therefore provide actionable opportunities to mitigate emerging vector-related risks in European cities.

Climbing to cool or descending to clean waters: thirty years of altitudinal shifts in Basque macroinvertebrates

Oier Frias-Abecia[1]*, Pavel Kratina[2], Aitor Larrañaga[1]

[1]Faculty of Science and Technology, University of the Basque Country, Sarriena auzoa, z/g., 48940, Leioa, Spain
[2]School of Biological and Chemical Sciences, Queen Mary University of London, Mile End Road, E1 4NS, London, United Kingdom

oier.frias@ehu.eus

Freshwater ecosystems host disproportionately high biodiversity relative to their habitat area, yet they are under an increasing pressure from human activities. For freshwater macroinvertebrates that spend their entire life cycle within the water, and for those that have an adult aerial phase, the relative importance of environmental drivers and anthropogenic pressures may differ. Understanding how different drivers modify species distributions across river networks is essential for the conservation of biodiversity and the maintenance of ecosystem functioning within, and in the vicinity of, freshwater ecosystems. Despite this importance, little is known about macroinvertebrate long-term migration patterns across river networks and how these patterns relate to life-cycle traits such as having an aerial adult stage. Here, we quantified 30-year dynamics in the abundance and taxonomic composition of aquatic macroinvertebrates differing in their life-cycle traits across Basque catchments. Using long-term monitoring data collected by the Basque Water Agency, we examined whether flying and non-flying taxa exhibit distinct responses to environmental drivers and human pressures. We show that both improvements in water quality and increases in air temperature drive substantial distributional shifts in macroinvertebrate communities, with clear differences between flying and non-flying taxa. These environmental changes displaced population gravity centres, including shifts toward higher altitudes. Overall, our findings highlight the need to account for life-cycle characteristics when assessing the impacts of global environmental change on freshwater biodiversity, as temporal changes in macroinvertebrate taxa with aerial adult stages can have dramatic consequences for key ecological linkages between aquatic and terrestrial systems.

How streams change over time? 30 years of community changes and seasonal dynamics

Iñaki Larretxi-Gallastegi[1]*, Daniel Montoya[1], Aitor Larrañaga[2]

[1]Basque Centre for Climate Change (BC3), Leioa, Spain. [2]Department of Plan Biology and Ecology, Faculty of Science and Technology, University of the Basque Country EHU, Leioa, Spain

inaki.larretxi@bc3research.org

Despite covering less than 3% of Earth's surface, freshwater ecosystems are highly biodiverse (they host nearly 9.5% of all described animal species) and provide crucial services like drinking water, food and recreation. However, a long history of anthropogenic exploitation has made freshwater ecosystems among the most heavily impacted during the ongoing sixth mass extinction. In this context, high-resolution time series are essential to provide evidence-based management, infer trends in taxonomic and functional diversity, and ultimately understand how biological communities respond to stressors over time. In this study, we analyze long-term data gathered by the Water Agency of the Basque Country from over 170 sampling sites corresponding to 21 river catchments in Northern Spain, including biological (e.g., macroinvertebrate and fish abundance), hydromorphological (e.g., flow and habitat quality indexes), and more than 21 abiotic variables. These variables were sampled twice a year across 30 years, thereby providing both interannual and intraanual (i.e., seasonality) information. Here we present trends in abundance, taxonomic and functional diversity in relation to the physicochemical properties of the habitat, and explore changes in seasonality over the past decades. Our results reveal a significant decline in fish abundance and diversity, and a slight increase in both the abundance and diversity of macroinvertebrates. River catchments show a trend towards environmental homogenization as they become more oxygenated and less polluted. Since river physicochemical status improved over the past three decades, the observed differences among macroinvertebrate and fish may be driven by hydromorphological alterations. Intraanual differences in abundance between samplings before and after the summer period have diminished and, in some cases, reversed, suggesting a shift in the phenology of the organisms studied. Altogether, our study highlights the potential value of exploring manager-gathered data from water quality monitoring to reveal long-term and seasonal patterns in freshwater communities essential for tackling the challenges posed by global change.

Metodología para la tipificación de eventos de turbidez extrema en el Mar Menor: revisión de procesos y escalas

Belén López-Rubio*, Elena Sánchez-Badorrey

Instituto de Investigación del Agua - ETSICCP Área de Ingeniería Hidráulica, Universidad de Granada

belenlr@correo.ugr.es

En lagunas someras oligotróficas, la turbidez y la transparencia son indicadores estándar de calidad del agua y estado trófico. Este es el caso de la Laguna del Mar Menor (Murcia, España), que con una profundidad máxima de 7 m, tiene valores de referencia del coeficiente de extinción en columna de agua inferiores a 0.4 m^{-1} que ha permitido sustentar hasta el 2015, extensas praderas de *Cymodocea nodosa*, *Caulerpa prolifera* y una productividad bentónica característica. A partir del 2015, la Laguna ha experimentado varias crisis asociadas a eventos de turbidez extrema (ETEs) que han transformado su estructura físico-química y biológica. En la literatura, se identifican tres mecanismos principales: (1) escorrentía durante eventos de precipitación, (2) eutrofización y (3) blanqueamiento (whiting). Adicionalmente, la resuspensión de sedimentos inducida por oleaje local en condiciones de temporal puede generar ETEs en extensiones considerables de la Laguna, favoreciendo la liberación de nutrientes y contaminantes retenidos en el sedimento. Aquí, presentamos una metodología para la tipificación de ETEs en esta Laguna en función de su mecanismo generador y de sus escalas espacio-temporales características. La metodología integra: (1) análisis estadístico de bases de datos históricas de calidad del agua, forzamientos meteorológicos y variables hidrológicas, (2) información satelital y (3) modelado numérico de eventos de resuspensión por oleaje local simulado con el modelo espectral SWAN. Esta metodología ha permitido elaborar un catálogo sistemático de ETEs en el Mar Menor desde el 2015. Los resultados muestran que la resuspensión inducida por el oleaje es un mecanismo relevante, especialmente en un contexto de pérdida progresiva de macrófitos, y da lugar a un número significativo de ETEs de escala diaria. Sin embargo, sólo el 4% de estos eventos entre 2018 y 2023 han sido monitorizados. Lo que evidencia la necesidad de revisar los programas de seguimiento ambiental y gestión de la Laguna.

Spatial and temporal factors driving plastic pollution in the riparian zone of a Mediterranean river

Eugènia Martí[1]*, Delfina Cornejo[1,2], Berta Bonet[1], Henar Margenat[1], Joan Blavia[1], Sara Castelar[1], Miquel Ribot[1], David Calvo[1], Wilfred M. Wollheim[3], Timothy J. Hoellein[4], Helena Guasch[1]

[1]Integrative Freshwater Ecology Group, Center for Advanced Studies of Blanes (CEAB-CSIC), Spain. [2]University of Girona, Spain. [3]Earth Systems Research Center,University of New Hampshire, Durham, NH, USA. [4]Department of Biology, Loyola University Chicago, Chicago, IL, USA

eugenia@ceab.csic.es

Riparian zones are located at the interface between terrestrial and fluvial ecosystems; and thus, are particularly vulnerable to plastic pollution. Mismanaged plastic can reach riparian zones from local inputs of adjacent urban, industrial or agricultural areas. In addition, during high flow conditions or episodic floods, plastic can be flushed from riparian zones into the stream and transported downstream, where in turn, it can be trapped again, especially in the presence of vegetation. Therefore, abundance of plastic in riparian zones can result from the interplay between local human activity and the net effect of stream hydrologic dynamics. Here, we assessed plastic pollution (i.e., abundance and category type of the fraction >5 mm, macroplastic-MacP) in the riparian zones of a Mediterranean stream, and examined how it is affected by the catchment land use and the stream hydrological regime. Thirteen sites spanning forested, agricultural, and urban areas were surveyed for MacP abundance on a single date in the riparian zone and stream channel. Additionally, five sites were sampled bimonthly to assess temporal variation of MacP abundance. MacP abundance was higher in riparian zones (67%) than in the stream channel (<15%), which indicates riparian zones as hot spots for plastic accumulation. Abundance of MacP was higher in riparian zones nearby urban areas than in forested and agricultural areas. This evidences the different effect of human activities on plastic pollution in riparian zones. Floods caused a distinct effect on MacP abundance among riparian zones, which was mostly associated with the vegetative structure of these zones than with their location along the fluvial network. Together, these results shed light about factors and mechanisms explaining dynamics of plastic pollution in stream- riparian ecosystems and how they can act as transient storage or sources of terrestrial plastic pollution to marine ecosystems.

Coastal Lagoons at Risk: What Satellites Tell Us About Eutrophication Trends in the Western Mediterranean

Juan Víctor Molner[1]*, Viola Pagliani[2], Noelia Campillo-Tamarit[1], Elena Arnau-López[1], Manuel Muñoz-Colmenares[1], Juan M. Soria[1]

[1]Cavanilles Institute of Biodiversity and Evolutionary Biology (ICBiBE), Universitat de València, Catedrátic José Beltrán Martinez, 2, 46980 Valencia, Spain. [2]Department of Ecology, Environment and Plant Sciences (DEEP), Stockholm University, Svante Arrhenius Väg 20 A, 114 18 Stockholm, Sweden

juan.molner@uv.es

Mediterranean coastal lagoons are priority habitats currently facing chronic anthropogenic pressures. This study integrates two complementary remote sensing approaches to evaluate the evolution of trophic status in ten key lagoon systems over the last decade (2015–2025), utilizing the high-resolution capabilities of the Sentinel-2 constellation. We assessed nine major Italian coastal lagoons (including Venice, Comacchio, and Cabras) using automated atmospheric correction processors (C2RCC/C2X) to identify regional patterns. Results revealed a landscape predominantly characterized by eutrophic to hypertrophic conditions. While the Mare Piccolo maintained a stable oligotrophic status, significant degradation trends were identified in the Cabras and Varano lagoons ($p < 0.05$), with the latter showing a concurrent decline in transparency. We also focused on the Albufera of Valencia (Spain), a hypertrophic system where we applied regionally calibrated algorithms validated with a nine-year in situ dataset. This high-precision local analysis confirmed a statistically significant deterioration of ecological quality, detecting increasing trends in Chlorophyll-a and Suspended Solids ($p < 0.01$), effectively quantifying the failure of recent management interventions to reverse the turbid state. By combining these datasets, we demonstrate "what satellites tell us": despite different hydro-morphologies and management strategies, most studied Mediterranean lagoons exhibit stagnation or decline in ecological quality. This decadal perspective underscores the urgency of adaptive management in the face of global change. The comparison highlights the versatility of Sentinel-2, effective both for broad regional screening using automated products and calibrated algorithms for precise monitoring of complex waters.

Assessing Nature-Based Solutions for groundwater recovery: A managed aquifer recharge pilot in the Addaia aquifer (Menorca, Spain)

Aaron Ortega-Mclear[1]*, Juan Miguel Rosillo-Comino[1], Margalida Ramis-Oliver[1], Pablo Rodríguez-Lozano[2,3], Celso García[1]

[1]Department of Geography, University of the Balearic Islands, 07122 Palma, Spain. [2]Departament of Ecology, Autonomous University of Madrid, 28049 Madrid, Spain. [3]Research Center on Biodiversity and Global Change (CIBC-UAM), Autonomous University of Madrid, 28049 Madrid, Spain

aaron.ortega@uib.cat

The Addaia groundwater body (1903M1) is located in the northeastern part of Menorca (Balearic Islands, Spain), covering 18.87 km^2 within the Fornells hydrogeological unit. The aquifer is a free-type secondary system developed in Jurassic limestones and dolomites, hydraulically connected to the coastal wetland Albufera de Mercadal-Son Saura (Natura 2000). The water body holds a good quantitative status, with a balanced water budget and an exploitation index of 0.44, yet it fails to meet good chemical status. This poor qualitative condition is driven by seawater intrusion, elevated chloride concentrations (average 200 mg/l), nitrate contamination (average 27 mg/l) from agricultural pressure, and organic contaminants. The decoupling between good quantitative and poor qualitative status makes this a paradigmatic case of chemical degradation independent of overexploitation, posing a specific challenge under the Water Framework Directive. Within the NATALIE project (Nature-based solutions for Alternative water management in European Islands), NBS are being explored for Managed Aquifer Recharge (MAR) in the Son Saura area, upstream of the Albufera de Mercadal wetland. The approach investigates how infiltration of regenerated water, used for irrigation at an adjacent golf course, affects groundwater dynamics and wetland processes. A monitoring network of piezometric wells equipped with water level and conductivity sensors, provides data on groundwater levels, water quality and geological structure to build a conceptual hydrogeological model. Based on this diagnostic, the feasibility of a MAR spreading basin as a NBS is being assessed with regional authorities and stakeholders. The goal is to improve chemical status by diluting contaminants and counteracting seawater intrusion, without compromising the good quantitative balance. This case aims to be the first nature-based aquifer recharge experience in the Balearic Islands, offering a replicable model for Mediterranean island groundwater management.

Impact of climate change mitigation strategies on biodiversity across the freshwater-terrestrial interface

Néstor Pérez-Méndez[1]*, Maite Martínez-Eixarch[1], Dani Boix[2], Sebastián Echeverría-Progulakis[1]

[1]IRTA, Marine and Continental Waters Program, Centre de La Ràpita, 43540 La Ràpita, Catalonia, Spain. [2]GRECO, Institute of Aquatic Ecology, University of Girona, Girona, Catalonia, Spain

nestor.perez@irta.cat

Rice agroecosystems are important contributors to climate change through methane emissions, while also representing freshwater biodiversity hotspots and providing multiple agroecosystem services. Water-saving irrigation strategies have been globally implemented as climate change mitigation and adaptation practices in rice paddy fields as they decrease methane emissions and water use. Although such effects have been widely studied, information regarding outcomes in terms of biodiversity and overall agroecosystem multifunctionality remains overlooked. Here, we implemented a field-scale experiment to assess the effects of different irrigation strategies across a water use gradient (continuous flooding > mid-season drainage (MSD) > alternate wetting and drying (AWD)) on (i) the conservation of freshwater biodiversity, ii) the provision of ecosystem services (i.e. regulating and provisioning services), and iii) overall agroecosystem multifunctionality. None of the irrigation strategies benefited most taxa or improve most regulating services. For instance, AWD generally benefited microbial communities while hindering vertebrate populations. Similarly, different strategies promoted different sets of ecosystem services, ultimately resulting in similar levels of multifunctionality. Our results suggest that, from a landscape management perspective, implementing a single irrigation strategy at large spatial scales should be discouraged due to potential negative effects on particular sets of ecosystem service components. Conversely, a mosaic of irrigation strategies should be implemented, promoting ecosystem services aligned with site-specific landscape management objectives.

Long-term diatom monitoring in the Llobregat River Basin (2015–2024): assessing potential ecological responses to drought

Núria Llauradó Nolla[1]*, Pepita Nolla Querol[2]

[1]Universitat de Barcelona, 08028, Barcelona, España. [2]Phytolab Control, 08902, L'Hospitalet de Llobregat, España. [3]Tentamus LAB, 08902, L'Hospitalet de Llobregat, España

nllaurno10@alumnes.ub.edu

Diatoms are widely used as biological indicators for assessing the ecological status of rivers under the Water Framework Directive (WFD). Within the Catalan Water Agency (ACA) monitoring program, diatom communities across the Llobregat River Basin have been sampled and analysed between 2015 and 2024. The ecological status of each water body has been determined using the Indice de Polluosensibilité Spécifique (IPS). The Llobregat Basin is one of the major internal river basins in Catalonia and has historically been strongly disturbed due to intense urban, industrial, and agricultural pressures, making it a key system for evaluating ecological responses to hydrological stress. This study aims to explore whether the drought conditions experienced over the last decade may have had an impact on diatom communities, and whether factors such as the degree of disturbance, fluvial typology, or hydrological regime could influence water bodies' vulnerability to this stressor. Given the sensitivity of diatoms to nutrient load, the working hypothesis is that drought periods lead to a deterioration of ecological status due to reduced dilution capacity and increased influence of point source discharges, as well as other nutrient inputs derived from land use practices. These effects are expected to be more pronounced in water bodies with low or naturally variable discharge regimes and in mid basin sections with moderate levels of disturbance, where hydrological stress may favour higher nutrient concentrations and the dominance of eutrophic or pollution tolerant taxa. By integrating ecological, hydrological, and typological information, this study aims to assess whether certain river types or monitoring sites show a greater sensitivity to drought related pressures, contributing to a better understanding of climate driven impacts on Mediterranean river ecosystems and informing future management strategies.

Assessing the risks for Spanish river ecosystems

Sergi Sabater[1,2]*, José Barquin[3], Juanma Cintas[4], Ariadna Gabarda[1], Alex Gou[1], Alexia González-Ferreras[3], Jaime Martinez-Valderrama[4], Isabel Muñoz[5], Francisco Peñas[3]

[1]Catalan Institute for Water Research (ICRA), Emili Grahit, 101, Parc Científic i Tecnològic de la Universitat de Girona, 17003, Girona, Spain. [2]Universitat de Girona, Plaça de Sant Domènec, 3, 17004 Girona, Spain. [3]IHCantabria – Instituto de Hidráulica Ambiental de la Universidad de Cantabria, Santander, Spain. [4]Estación Experimental de Zonas Áridas, Consejo Superior de Investigaciones Científicas, 04120 Almería, Spain. [5]Universitat de Barcelona, Av. Diagonal, 643 08028, Barcelona

ssabater@icra.cat

In many Mediterranean regions the use of water resources is almost equivalent or even higher to their availability. This imbalance adds to the effects of land transformation, climate change, pollution, and fragmentation, compromising the conservation of both surface and groundwater ecosystems, and jeopardizing the availability and quality of water resources for human needs and river ecosystems. We here evaluated the risk for river ecosystems associated to climatic conditions and climate change as well as human consumption. These threats were first identified and prioritized following a survey including academics and managers. Then, their relevance was assessed considering the relative exposure and vulnerability of freshwater ecosystems throughout Spain. We assembled data to characterise river ecosystem vulnerability looking at physical, chemical and ecological characteristics. This assessment of risks was compared to the evidence contributed by the present state of aquifers and superficial waters, the intensity of irrigation crops and husbandry, and the relevance of tourism, among others. From that comparison, we outline the areas with higher risk for river ecosystems and relate them to the most relevant factors contributing to that situation. This exercise provides clear indication on how water security could be reinforced nationally to meet aquatic ecosystems demands and invest in adaptation to human and climate impacts.

Aguas de formación del petróleo en la Amazonía Ecuatoriana: contaminación, impacto y monitoreo local

Diego Sanz Yus[1]*, Ibon Tobes Sesma[2], Andrés Castañeda Chávez[3], Christian Villamarín Flores[3], Daniela Rosero López[4], Gabriela Echevarría Díaz[3], Kevin Poveda Ducón[6], Evgeny Bulatov[8], Pablo Castillejo[3], Blanca Ríos Touma[5], Andrea Encalada Romero[4], Ana López Antía[8], Martí Orta Martínez[7], Miguel Cañedo-Argüelles Iglesias[1]

[1]FEHM-Lab, SHE2, Institut de Diagnòstic Ambiental i Estudis de l'Aigua (IDAEA-CSIC), 08034 Barcelona, Spain. [2]Centro de Investigación de la Biodiversidad y Cambio Climático (BioCamb), Facultad de Ciencias de Medio Ambiente, Universidad Tecnológica Indoamérica, Quito 170103, Ecuador. [3]Grupo de Investigación Biodiversidad, Medio Ambiente y Salud (BIOMAS), Facultad de Ingenierías y Ciencias Aplicadas (FICA), Universidad de Las Américas, Quito 170503, Ecuador. [4]Laboratorio de Ecología Acuática, Global Research & Solutions Center, Universidad San Francisco de Quito, Quito, Ecuador. [5]Colegio de Ciencias Biológicas y Ambientales and Global Research & Solutions Center, Universidad San Francisco de Quito, Quito, Ecuador. [6]Instituto de Investigación e Ingeniería Ambiental/Consejo Nacional de Investigaciones Científicas y Técnicas/Universidad Nacional de San Martín (Buenos Aires) Argentina. [7]Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona, Barcelona, Catalonia, Spain. [8]Chemometrics for Environmental Omics, Institut de Diagnòstic Ambiental i Estudis de l'Aigua (IDAEA-CSIC), 08034 Barcelona, Spain

diego.sanz@idaea.csic.es

La Amazonía alberga una complejidad biocultural propia de uno de los ecosistemas más antiguos del planeta: la mayor cuenca fluvial de la Tierra desde hace millones de años. Depósitos de plancton y vegetación sedimentados a lo largo del tiempo dieron existencia a los reservorios de petróleo crudo y gas, que yacen en los poros de las formaciones geológicas, entre el agua intersticial o agua de formación. A medida que las reservas se explotan, el crudo cada vez es más denso, escaso y difícil de extraer, y, sin embargo, el agua se convierte en el subproducto más abundante. Las ratios de producción actual son de 90% agua de formación y 10% crudo, extraídos a través de más de 2000 pozos productores. Estas aguas son ricas en metales pesados, hidrocarburos y elementos radiactivos, tienen elevada salinidad y son muy corrosivas. Una vez en la superficie, se distribuyen a través de ductos hacia alrededor de 200 pozos reinyectores, que las introducen de nuevo en los reservorios. El manejo de tan grandes volúmenes de aguas de formación conlleva numerosos riesgos, por ejemplo, derrames, infiltraciones subterráneas o malas prácticas. Presentaremos resultados preliminares derivados del análisis de conductividad en distintos cuerpos de agua destinados a definir los lugares óptimos para la aplicación articulada de metodologías complementarias. Esta investigación busca determinar la contaminación en cuerpos de agua y sedimento, el impacto en la biodiversidad y el fortalecimiento de redes de monitoreo locales mediante el uso de tecnologías libres para detectar los incrementos en la conductividad de los cuerpos de agua que podrían asociarse a la contaminación por aguas de formación.

Carbon burial in reservoirs is not a relevant net anthropogenic perturbation of the global carbon cycle

Daniela Henry[1], Krati Sharma[2]*, Joan Pere Casas-Ruiz[3], Biel Obrador[4], Núria Catalán[2], Rafael Marcé[2]

[1]Institute of environmental assessment and water research (IDAEA-CSIC), 08034, Barcelona, Spain. [2]Centre d'Estudis Avançats de Blanes (CEAB-CSIC), Blanes, Espanya. [3]Mediterranean Institute for Advanced Studies (IMEDEA-UiB- CSIC); Esporles, 07190, Spain. [4]Departament de BiologIa Evolutiva, Ecologia i Ciències Ambientals, Universitat de Barcelona, Av Diagonal, 643 Barcelona (08028), España

krati.sharma@ceab.csic.es

The role of reservoirs as an anthropogenic perturbation of the carbon cycle remains debated. On one hand, their function as methane emitters following impoundment is now widely acknowledged and incorporated into the IPCC guidelines for National Greenhouse Gas Inventories. On the other hand, some authors have argued that reservoirs can also act as carbon sinks through the burial of organic carbon in sediments, potentially offsetting part or all of their methane emissions. Here we present a new global-scale model for carbon burial along the land-to-ocean aquatic continuum (LOAC-OCB v1.0), including lakes, reservoirs, floodplains and blue-carbon coastal ecosystems. By analysing different scenarios related to the global prevalence of reservoirs in river networks, we use LOAC-OCB to show that organic carbon burial in reservoirs does not constitute a significant net anthropogenic perturbation of the global carbon cycle (from a carbon accounting perspective). Most of the organic carbon currently sequestered in the sediments of reservoirs would, in the absence of these systems, be buried in other ecosystems along the LOAC. In particular, floodplains would retain the majority of this organic carbon under natural conditions. Although some regional differences exist, our results indicate that carbon burial in reservoirs is generally not a relevant net anthropogenic perturbation of the global carbon cycle. Consequently, methane emissions from reservoirs are unlikely to be substantially offset by net organic carbon burial in these systems if the emissions are considered at large scales. The substantial burial that would occur in other ecosystems of the LOAC in natural conditions must be considered though a perturbation from damming beyond the carbon accounting perspective.

Effectiveness of riparian forests as ecological buffers: insights from the Galician riverscape

Mateo Soto-Tielas[1]*, Noé Ferreira-Rodríguez[1], Anna Lupon[2], Isabel Pardo[1]

[1]Department of Ecology and Animal Biology, Universidade de Vigo, 36310 Vigo, Spain. [2]Integrative Freshwater Ecology Group, Centre d'Estudis Avançats de Blanes (CEAB-CSIC), Blanes, Spain.

mateo.soto.tielas@uvigo.gal

Freshwater ecosystems in Galicia (NW Iberian Peninsula) face multiple stressors from agriculture, dispersed urbanization, and forestry plantations (eucalyptus, pine), which degrade water quality and physical habitat. To assess the effectiveness of riparian forests as ecological buffers, we intensively studied 169 Galician rivers, and we applied a methodological approach designed to identify impacts at different spatial scales (catchment, riparian, and reach), along multiple pressures intensification gradients. Generalized Additive Models (GAMs) were fitted to compare different models including basin and riparian predictors alone, and combined models to predict water chemistry ($N\text{-}NO_3$ or $P\text{-}PO_4$) and habitat conditions. The connection between riparian variables and basin use types showed a significant predictive capacity for nutrient levels and habitat, indicating that riparian conditions are linked to nutrient concentrations and habitat status. We conclude that riparian forests are highly effective ecological buffers, mitigating multiple impacts to rivers. These results serve as a fundamental support for ecological restoration works, since stressors arising from pressures at the basin level can be effectively mitigated by defining appropriate characteristics for riparian forests.

Integrating hydrodynamic modelling with machine learning to predict the effects of climate change on urban stream biota

Andreina Zerega[1]*, Nuno Eduardo Simões[2], Ana Raquel Calapez[1], Jorge Santos[1], Alexandra Ribeiro[3], Janine Pereira da Silva[1], Maria João Feio[1]

[1]MARE- Marine and Environmental Sciences Centre /ARNET- Aquatic Research Network, Department of Life Sciences, Faculty of Science and Technology, University of Coimbra, Portugal. [2]INESCC- Institute for Systems Engineering and Computers at Coimbra, Department of Civil Engineering, Faculty of Sciences and Technology, University of Coimbra, Portugal. [3]Department of Civil Engineering, Coimbra Institute of Engineering, Polytechnic Institute of Coimbra, Portugal

zeregamarques@student.uc.pt

Urban streams are exposed to the combined effects of climate change and persistent anthropogenic pressures. However, predicting ecological responses under future conditions remains challenging. This study evaluates how projected climate scenarios may alter macroinvertebrate communities in urban streams by coupling hydrodynamic modelling with a predictive machine learning ecological approach. A regional dataset from central Portugal was used to develop a HYDRA model to predict macroinvertebrate taxon occurrence based on environmental conditions. Flow variables were simulated using hydrodynamic models to represent future climatic scenarios. The models were applied to forecast changes in the invertebrate communities of 14 urban stream sites in Coimbra, Portugal, under four climate change scenarios: medium-term (2041-2060) projections under the lowest and highest emission pathways, and long-term (2081-2100) under the lowest and moderate pathways. Climate projections indicated consistent warming and an intensification of extreme rainfall events, resulting in higher simulated spring baseflows and reduced flow variability across scenarios. The macroinvertebrate assemblages and biological metrics (family richness, IBMWP, %EPT, %Chironomidae), varied among sites and were constrained by baseline urbanisation levels. Less urbanised streams, which supported richer and more sensitive baseline assemblages, experienced greater ecological declines under higher emission scenarios, whereas highly urbanised streams exhibited weaker or neutral responses, limited by prior biological simplification. Sites with initially high scores maintained water quality class despite declines in IBMWP scores, while sites with initially low scores generally improved. Taxonomic shifts were characterised by losses of cold-adapted and flow-sensitive taxa, alongside the persistence or colonisation of tolerant and generalist taxa, while functional feeding group composition remained largely stable. Although less urbanised streams experienced greater ecological declines, they maintained higher overall biological quality than more degraded sites, suggesting that ecosystems with better baseline condition exhibit greater resilience to the effects of climate chang, reinforcing the importance of preserving and rehabilitating urban streams.

From brown to green: How land-use intensification and invasive predators reshape headwater food webs

Urtzi Arteagabeitia[1]*, Javier Pérez[2,3], Alberto Alonso[1], Mikel Bilbao[1], Nestor Etxebarria[4,5], Juan Rubio-Ríos[2,6,7], Diana Rojo[1], Viviane Caetano[8], Gabriela García[9], Aydeé Cornejo[9,10,11], J. Jesús Casas[2,3], Luz Boyero[1,12]

[1]Stream ecology Lab. Dept. of Plant Biology and Ecology, Faculty of Science and Technology, University of Basque Country EHU, Leioa, Spain. [2]Andalusian Centre for the Global Change – Hermelindo Castro (ENGLOBA), Almeria, Spain. [3]Department of Biology and Geology, University of Almería, Almería, Spain. [4]Department of Analytical Chemistry, University of the Basque Country EHU, Leioa, Basque Country, 48940, Spain. [5]Plentzia Marine Station (PiE-EHU), Plentzia, Basque Country, 48620, Spain. [6]Biodiversity and Conservation Area, University King Juan Carlos, Madrid, Spain. [7]Instituto de Investigación en Cambio Global (IICG), 28933 Móstoles, Spain. [8]Postgraduate Program in Ecology, Institute of Biological Sciences, Federal University of Pará (UFPA), Belém, Brazil. [9]Doctoral Program in Biosciences and Biotechnology, Faculty of Science and Technology, Technological University of Panama, Panama City 0819-07289, Panama. [10]Ecology and Aquatic Ecotoxicology Laboratory, Research Center for Emerging and Zoonotic Diseases, Gorgas Memorial Institute of Health Studies, Santiago Este 0816-02593, Veraguas, Panama. [11]National Research System (SNI), National Secretariat of Science, Technology and Innovation (SENACYT), Panama City 0816-02852, Panama. [12]IKERBASQUE, Basque Foundation for Science, Bilbao, Spain

urtzi.arteagabeitia@ehu.eus

Forested headwater streams depend on detrital leaf litter inputs from surrounding forest, with the 'brown' pathway being the food-web base, as primary production is limited by shading and oligotrophic conditions. However, under degraded conditions (e.g., loss of riparian forest, agroforestry and urban land uses, nutrient and toxin runoff), ecosystem functioning can be disrupted, shifting energy flow toward the green pathway, supporting less diverse biological communities but enhancing the secondary production of tolerant taxa. In addition to these anthropogenic alterations, invasion by the signal crayfish (*Pacifastacus leniusculus*), a highly harmful alien species, can further alter the structure and functioning of headwater streams. Their omnivorous behaviour, combining detritivorous, herbivorous and predatory habits, alters stream food webs. To evaluate these interactions, we conducted a field experiment in six streams distributed along a gradient of disturbance (i.e., agroforestal uses). In each stream, we examined leaf litter decomposition, primary production, and associated communities under three experimental conditions: the open benthos, and instream enclosures with and without crayfish. Our design allowed to assess the direct and indirect impacts of signal crayfish and their interaction with the multiple stressors derived from the studied disturbance gradient. The physicochemical and structural characterization of our six study streams confirmed an increase in nutrient availability and the presence of toxins in the most disturbed rivers, which was reflected in impoverished communities. Along the gradient of increasing disturbance, a trend toward higher rates of decomposition and primary production was observed, coinciding with an increase in invertebrate abundance. However, sensitive taxa tended to be replaced by tolerant taxa, and diversity was reduced. The presence of signal crayfish significantly altered stream ecosystem functioning and associated communities, with an intensification of the effects of habitat degradation, which could compromise ecosystem health and stability.

Does detritus of the invasive *Acacia dealbata* affect the colonization and decomposition of native leaf litter by stream decomposers?

Alice Caetano[1], Manuela Abelho[1], Verónica Fereira[2]*

[1]Coimbra Agriculture School, Polytechnic Institute of Coimbra, 3045-601 Coimbra, Portugal. [2]MARE – Marine and Environmental Sciences Centre, ARNET – Aquatic Research Network, Department of Life Sciences, University of Coimbra, 3000-456 Coimbra, Portugal

veronica@ci.uc.pt

Biological invasions are a major threat to biodiversity and ecosystem functioning worldwide. In particular, plant invasion of riparian forests can have strong effects on stream communities and processes. In previous studies, we found faster microbial-driven decomposition of leaf litter in streams flowing through forests invaded by the evergreen, nitrogen-fixer *Acacia dealbata* than through uninvaded mixed deciduous forests, but the mechanisms are not clear. Here, we assessed litter mixing effects of binary mixtures composed of leaf litter from native species and *A. dealbata* detritus. We used laboratory microcosms with detritus in monocultures (alder or oak leaf discs, *A. dealbata* leaflets, flowers or pods; 5 treatments) and microcosms with binary mixtures (50:50) of leaf discs from one of the native species (alder or oak) and one of the *A. dealbata* detritus (leaflets, flowers or pods) (6 treatments), in a total of 11 treatments. Litter decomposition rates were highest for treatments containing alder leaves and *A. dealbata* flowers (0.0070 – 0.0093, /d) and lowest for treatments containing *A. dealbata* pods (0.0020 – 0.0037, /d). Synergistic litter mixing effects were found for the decomposition of the mixtures alder leaves x A. *dealbata* flowers and oak leaves x *A. dealbata* pods. Cumulative conidial production by aquatic hyphomycetes over 70 days varied between 3807 and 18290 conidia/mg dry mass across treatments, being lowest for the treatments *A. dealbata* pods and oak leaves x *A. dealbata* pods. Synergistic litter mixing effects were found for conidial production of the mixtures alder leaves x *A. dealbata* pods and oak leaves x *A. dealbata* leaflets. Aquatic hyphomycetes taxa richness and community structure differed between *A. dealbata* pods and other treatments. We can conclude that *A. dealbata* detritus interacts with native leaf litter and affects the microbial colonization and decomposition of detritus, which can be explained by niche complementary or nutrients release.

Visor de especies exóticas invasoras acuáticas (EEIA) CEDEX-MITERD (https://ceh.cedex.es/visoreei/visor/principal/index.html)

Laura Hernández Sánchez*, Neftali Roblas Moreno, Jose Antonio de la Ossa Carretero, Manuel Toro Velasco

Centro de Estudios Hidrográficos, CEDEX, Pº Bajo Virgen del Puerto nº 3, 28005 Madrid, España

Laura.Hernandez@cedex.es

La introducción y expansión de especies exóticas invasoras (EEI) constituye una de las amenazas más relevantes para la biodiversidad a escala global y nacional. Algunas de ellas suponen además un importante impacto económico, sobre la salud, etc. Conscientes de esta situación, desde las administraciones competentes en la materia se ha promovido el desarrollo de normativa e iniciativas para combatir este problema creciente. En este contexto, la Dirección General del Agua (MITERD) y el Centro de Estudios Hidrográficos del CEDEX (MITERD-MITMA), iniciaron en 2022 los trabajos para la creación de un visor web que aglutinara la información disponible a escala nacional sobre la presencia de EEI en las masas de agua epicontinentales. Fruto de este acuerdo se ha desarrollado el denominado Visor de Especies Exóticas Invasoras Acuáticas (EEIA); una herramienta cartográfica interactiva, accesible en línea, concebida para facilitar la visualización, consulta y descarga de datos actualizados sobre la distribución geográfica y evolución temporal de especies exóticas invasoras en las masas de agua continentales de España. Este Visor se alimenta tanto de los datos provenientes de los programas de seguimiento del estado ecológico de las masas de agua (integrados en la base de datos NABIA de la DGA), como de diferentes fuentes documentales relacionadas con la detección y dinámica de EEI en ecosistemas acuáticos continentales. Actualmente el Visor contiene 37478 referencias sobre 200 especies y permite la consulta interactiva a partir de 4 criterios: “Especie”, “Demarcación Hidrográfica”, “Masa de Agua” y “Rango de años”. Toda la información es descargable tanto en formato tabla (csv), como geográfico (geojson). Además, se dispone de fichas para cada especie detectada con el objeto de proporcionar información básica sobre aspectos ecológicos y de gestión.

Monitorización del mejillón cebra en embalses de la Comunidad de Madrid: evolución metodológica y evaluación preventiva

María Lezcano Basurto*, Merit del Rocio Mora Ruiz

Canal de Isabel II, Santa Engracia 125, 28003, Madrid, España

mclezcano@canal.madrid

La presencia del mejillón cebra (*Dreissena polymorpha*) en ecosistemas acuáticos constituye una potencial amenaza para la gestión del ciclo integral del agua. Desde 2015 hasta 2022, se ha desarrollado e implementado un programa de monitorización en embalses de la Comunidad de Madrid basado en métodos biológicos tradicionales, como redes de filtrado, trampas de asentamiento y observación directa. A partir de 2023, este programa se ha reforzado mediante técnicas de análisis genético en nuevos puntos de control establecidos en las plantas de tratamiento, lo que ha incrementado la sensibilidad para la detección temprana y la caracterización de posibles focos de invasión. Hasta la fecha, no se han registrado resultados positivos en ningún punto de la red. Este trabajo no sólo refleja los beneficios de programas de seguimiento como medida de vigilancia preventiva y proactiva, sino que también evidencia la importancia de la evolución metodológica en el control de especies invasoras y su contribución a la sostenibilidad y gobernanza ambiental en el ámbito del agua urbana

A global concentration of alien species in freshwater ecosystems

Albert Medina*, Alba Sevilla-Navarro, Belinda Gallardo

Instituto Pirenaico de Ecología, CSIC. Avda. Montañana 1005. 50192 Zaragoza, Spain

albertmedina000@gmail.com

Freshwater ecosystems are disproportionately affected by biological invasions, yet they remain underrepresented in global databases, many of which only cover certain taxa or geographic regions. This limits our ability to assess the current status and temporal trends of freshwater introduced and alien species (FRIAS). To address this gap, we developed FRIAS, a reproducible workflow to generate the first global dataset to characterize global patterns of alien species in freshwater ecosystems. The current version of FRIAS compiles 3,865 species from 94 online sources and the scientific literature, providing standardized information on taxonomy, functional feeding group, introduction pathways, native and recipient ranges, ecological impacts, and year of first record. Based on FRIAS and accounting for differences in surface area, exotic species are clearly overrepresented in freshwater systems compared with terrestrial and marine ones, with fishes representing the dominant taxonomic group. In addition, our preliminary results show that introduction rates increased markedly in the early 1940s, peaked in the 1970s, and were largely driven by species introduced as commodities. Western Europe and North America hosted the highest numbers of reported species, with the United States recording more than twice as many as the next-ranked country, France. The composition of exotic species in the United States and Western Europe is also highly similar, likely reflecting their long-standing and intensive bilateral trade relationships. Moreover, species with broader native distributions tend to occupy larger recipient ranges. Among taxa with available impact data, plants generated the strongest impacts, whereas amphibians showed the weakest. Overall, this work provides the first integrated global assessment of spatiotemporal patterns and impacts of freshwater alien species, highlighting priorities for improved monitoring, prevention, and management.

Do leachates of the invasive tree species *Acacia dealbata* affect the colonization and decomposition of native leaf litter by stream decomposers?

Maria Pinto[1]*, Mara E.M. Braga[2], Paula Lorenzo[3], Verónica Fereira[4]

[1]Department of Biology, University of Aveiro, 3810-193 Aveiro, Portugal. [2]CERES – Chemical Engineering and Renewable Resources for Sustainability, Department of Chemical Engineering, University of Coimbra, 3030-790 Coimbra, Portugal. [3]External Collaborator at CFE – Centre of Functional Ecology - Science for People & the Planet, TERRA – Associate Laboratory for Sustainable Land Use and Ecosystem Services, University of Coimbra, 3000-456 Coimbra, Portugal. [4]MARE – Marine and Environmental Sciences Centre, ARNET – Aquatic Research Network, Department of Life Sciences, University of Coimbra, 3000-456 Coimbra, Portugal

mariaipinto@ua.pt

Biological invasions pose a significant threat to ecosystem functioning. Riparian forests are particularly vulnerable to plant invasions, which can alter aquatic processes and communities. While invasive tree species like *Acacia dealbata* can significantly impact streams, the mechanisms of their action remain poorly understood. Here, we evaluated the effects of different types of *A. dealbata* leachates on the decomposition of native alder and oak leaf litter by stream microbial decomposers, using laboratory microcosms kept in the dark at 15 °C for 70 days. We tested *A. dealbata* leachates derived from litter collected during two seasons: summer (composed mainly of pods) and winter (composed mainly of flowers). Leachates were either incubated with charcoal (to reduce the presence of allelopathic compounds) or without charcoal. Each leachate type (season x presence/absence of charcoal) was tested at two concentrations (50% and 100%), resulting in 8 leachate treatments. For each species, we included a control group where leaf litter was incubated in water (0% leachate). For alder, litter decomposition rates were reduced by the winter leachates at 100% concentration, disregarding incubation with charcoal. For oak, litter decomposition rates were reduced by the winter leachate incubated without charcoal at 50% concentration. These effects reflect the reduced activity of microbial decomposers in the presence of winter leachates. Leachate type also affected microbial decomposer community structure, with some aquatic hyphomycete species being sensitive and having their reproductive activity strongly reduced in the presence of winter leachates. We conclude that *A. dealbata* leachates negatively affect the degradation and microbial colonization of native leaf litter, especially when derived from winter organic matter. This can be attributed to the release of allelopathic compounds such as phenols and tannins.

Quantifying the ecological impacts of non-native species across the Iberian Peninsula and archipelagos

Ismael Soto[1]*, Henrique Couto[2], Francisco J. Oficialdegui[1,3], Rebecca Pabst[4], Christos Gkenas[5], Andrea Anton[6], Elena Angulo[7], Lucia Espasandín[8], Daniel Bohorquez Puentes[6], Carlos Cano- Barbacil[9,10,11], Daniel Sánchez-García[7], Federica Rossetto[12,13], Laís Carneiro[14], Franck Courchamp[14], Emili García-Berthou[11]

[1]University of South Bohemia in Ceske Budejovice, Faculty of Fisheries and Protection of Waters, South Bohemian Research Center of Aquaculture and Biodiversity of Hydrocenoses, Zátiší 728/II, 389 25 Vodňany, Czech Republic. [2]Centre of Geographical Studies, Institute of Geography and Spatial Planning, University of Lisbon, Rua Branca Edmée Marques, 1600-276 Lisboa, Portugal. [3]Department of Conservation Biology and Global Change, Doñana Biological Station (CSIC), Seville, Spain. [4]Global Health and Tropical Medicine, GHTM, LA-REAL, Institute of Hygiene and Tropical Medicine, IHMT, NOVA University Lisbon, Lisbon, Portugal. [5]MARE, Marine and Environmental Sciences Center/ARNET, Aquatic Research Network, Faculty of Sciences, University of Lisbon, 1749-016 Lisbon, Portugal. [6]IMEDEA: Institut Mediterrani d'Estudis Avancats. [7]Estación Biológica de Doñana (CSIC), Avda. Américo Vespucio 26, 41092, Sevilla, Spain. [8]Institute of Marine Sciences (ICM-CSIC), Passeig Marítim de la Barceloneta, 37-49, 08003, Barcelona, Spain. [8]Departamento de Biodiversidad y Biología Evolutiva, Museo Nacional de Ciencias Naturales, CSIC, Madrid, Spain. [9]Department of River Ecology and Conservation, Senckenberg Research Institute and Natural History Museum, Gelnhausen, Frankfurt, Germany. [10]GRECO, Institute of Aquatic Ecology, University of Girona, Girona, Spain. [11]Biodiversity Research Institute (CSIC, Oviedo University, Principality of Asturias), Campus de Mieres, Edificio de Investigación – 5ª planta, C. Gonzalo Gutiérrez Quirós s/n, 33600, Mieres, Spain. [12]Pyrenean Institute of Ecology (IPE-CSIC), Avda. Montañana 1005, Campus de Aula Dei, 50059, Saragossa, Spain. [13]Université Paris-Saclay, CNRS, AgroParisTech, Ecologie Société Evolution, 91190, Gif-sur-Yvette, France

ism-sa@hotmail.com

La Península Ibérica y sus archipiélagos asociados (Islas Canarias, Baleares, Azores y Madeira) constituyen un hotspot de biodiversidad altamente vulnerable a las invasiones biológicas. En este estudio, cuantificamos y sintetizamos los impactos ecológicos de especies no nativas en esta región mediante la base de datos InvaPact v.1.0, que integra más de 3,700 registros de impacto correspondientes a 159 especies invasoras. La Península Ibérica presenta una gran riqueza y número de impactos, con predominancia de especies animales, mientras que en las Islas Baleares y Macaronesia predominan las plantas y peces, respectivamente. Los impactos se distribuyen heterogéneamente, concentrándose en áreas costeras y regiones con alta densidad humana. Nuestro análisis revela que las especies con mayor impacto incluyen *Procambarus clarkii*, *Azolla filiculoides* y *Acacia longifolia* en la Península Ibérica; *Hemorrhois hippocrepis* y especies vegetales invasoras en Baleares; y *Carassius auratus* y *Cyprinus carpio* en Macaronesia. Los mecanismos de impacto más prevalentes y severos son la alteración estructural del hábitat, la competencia y los efectos químicos, con variaciones regionales. además, documentamos impactos sobre especies nativas de alto valor conservacionista, incluyendo cinco especies críticamente amenazadas en la Península Ibérica, como *Mustela lutreola* y *Anguilla anguilla*, afectadas por múltiples invasores. Los ecosistemas marinos son los más afectados a nivel regional, aunque en la Península Ibérica predominan los impactos en hábitats terrestres. Nuestros resultados destacan la urgencia de implementar estrategias de gestión focalizadas en especies con mayor impacto, enfatizando la vigilancia transnacional, la detección

temprana mediante técnicas moleculares y la sensibilización pública. La integración de esta evaluación cuantitativa proporciona una base sólida para el diseño de políticas y acciones de conservación orientadas a mitigar las consecuencias ecológicas de las invasiones biológicas en esta región.

Valoración de los efectos de las crecidas en el río Duero, sobre el hábitat piscícola

Domingo Baeza*, Salvador Mollá, Eugenio Rico

Departamento de Ecología, Universidad Autónoma de Madrid, C/ Darwin, 2 Edificio de biología. Campus de Cantoblanco 28049 Madrid. Spain

domingo.baeza@uam.es

Esta investigación se incluye en los objetivos del proyecto ENGAGEMENT, que trata de aportar datos de investigación y propuestas para conseguir llanuras de inundación resilientes y ecosistemas fluviales mejor conservados, integrando en la gestión de los riesgos de inundación los procesos naturales y la intervención de las comunidades ribereñas. En concreto, el trabajo se ha centrado en un tramo del río Duero entre las localidades de Toro y Zamora, donde se han seleccionado tres tramos de trabajo de unos 1000 m de longitud, uno por cada masa de agua, para realizar un estudio de la influencia de las crecidas del río en la evolución de la cantidad de hábitat para los peces. Los trabajos comenzaron en campo con la selección, dentro de la longitud total del río, de tres tramos representativos de la morfología de cada masa. Asimismo, se realizó un estudio de frecuencia de caudales para estimar valores extremos característicos, como el valor del caudal generador y el de continuidad. La evolución del hábitat se analizó mediante una metodología incremental del caudal, utilizando el programa River2D, que proporciona como resultados valores del hábitat piscícola en función de los cambios de caudal. En todos los casos se observó un incremento del hábitat con valores de caudal bajos hasta alcanzar un máximo y, posteriormente, un descenso provocado por el aumento de la velocidad. A partir de los 300–400 m^3/s, se producía una recuperación del hábitat diferente en cada tramo. En algunos casos, la mejora del hábitat se producía en las orillas y, en otros, en las nuevas zonas inundadas, también de forma distinta según la clase de edad. Estos resultados pueden orientar futuros proyectos de restauración morfológica dirigidos a optimizar la habitabilidad del tramo.

Back to meandering: restoring river bends to recover lost ecological functions

Miriam Colls[1]*, Oier Frías[1], Iñaki Larretxi[2], Ekain López[1], Maite Arroita[1], Arturo Elosegi[1], Aitor Larrañaga[1]

[1]Department of Plant Biology and Ecology, University of the Basque Country / Euskal Herriko Unibertsitatea, EHU, Barrio Sarriena, s/n, 48940 Leioa, Spain. [2]Basque Centre for Climate Change (BC3), Leioa, Spain

miriam.colls@ehu.eus

River ecosystems are among the most degraded on the planet after decades of hydromorphological alterations, pollution, and disconnection from their floodplains, which limit their capacity to provide essential services such as hydrological regulation, nutrient retention, and biodiversity maintenance. The loss of geomorphological complexity reduces hydraulic heterogeneity and the interactions between water, sediment, and biota, thereby affecting ecosystem resilience. Restoration has emerged as a nature-based solution to reverse this degradation. It is not only about renaturalizing the landscape, but also about recovering fluvial dynamics that sustain key processes such as self-purification, a biogeochemical mechanism that improves water quality. Within the European RECHARGE project, we evaluate how meander reconnection and the creation of new pools in four rivers in Belgium, Poland, Portugal, and Spain contribute to improving water quality. Particularly, we analyse the role of these restored habitats in the retention and transformation of nutrients (NH_4^+, NO_3^-, PO_4^{3-}). Our results show that the recovery of meanders and pools, and consequently the increase in water residence time, stimulates microbial activity and enhances the system's capacity to retain and transform nutrients, complementing the self-purification functions of the main channel. Moreover, these interventions increase lateral connectivity and habitat heterogeneity, strengthening the ecological resilience of the fluvial ecosystem. Overall, our findings demonstrate that meanders and pools, in addition to contributing to the hydromorphological restoration of the channel and mitigating flood impacts, act as green filters capable of reducing the impact of nutrient inputs into the system, facilitating the recovery of ecosystem services and advancing towards more sustainable river management.

Macroinvertebrate community recovery following hydromorphological stream restoration along a latitudinal gradient

Sílvia Gómez-Arcusa[1]*, Christine Anlanger[2,3], Mario Brauns[2], Juliano J. Corbi[4], Patrick Fink[2,5], Nicolas R. Finkler[6], Davi G. Fernandes Cunha[7], Laila F. Oliveira de Assis[4], Björn Gücker[4], Julia Pasqualini[2], Daniel P. Abrahao[4], Daniel von Schiller[1], Ryan Sponseller[6], Isabel Muñoz[1]

[1]Universitat de Barcelona, Barcelona, Spain. [2]Helmholtz Centre for Environmental Research – UFZ, Magdeburg, Germany. [3]University of Kaiserslautern-Landau – RPTU, Landau, Germany. [4]Universidade Federal de São João del-Rei, São João del-Rei, Minas Gerais, Brazil. [5]University of Cologne, Institute for Zoology, Koeln, Germany. [6]Umeå University, Umeå, Sweden. [7]Universidade de São Paulo, São Carlos, São Paulo, Brazil

sgomezarcusa@ub.edu

Hydromorphological degradation represents an important threat to riverine ecosystems, affecting flow regimes, channel structure, riparian forest and habitat complexity, and has become a main target of river restoration efforts. In this study, we assessed the effectiveness of hydromorphological restoration in 12 streams across a broad latitudinal gradient spanning four countries: Brazil, Spain, Germany and Sweden, with contrasting environmental conditions that shape their macroinvertebrate community composition. We anticipated a recovery of the impaired structural community responses, but with region-specific differences in recovery magnitude. We analyzed community composition, density, biomass, richness, and alpha and beta diversity by comparing control reaches (without hydromorphological alterations), impacted reaches (with evident hydromorphological degradation) and restored reaches (where restoration interventions had been implemented). Restoration success was evaluated using forest plots based on the log response ratio (LnRR) to quantify the magnitude and directional change among reach types. This approach was combined with the Achieved Restoration index (AR), which integrates the condition of control, impacted and restored reaches to provide a standardized measure of accomplished recovery. Global results indicate that taxon richness and beta diversity recovered after restoration, converging towards control reach values, whereas density, biomass and alpha diversity showed contrasting responses across regions. The AR index further confirmed recovery in taxon richness following restoration, as well as improvements in beta diversity in most countries. Nevertheless, restoration success varied among countries, reflecting how regional environmental conditions and species pools shape the effectiveness of reach-scale restoration measures.

Unravelling the drivers of riparian degradation: *Arundo donax*, land-use intensification, and the limits of restoration in Mediterranean stream

Javier Pérez[1,2,3]*, Encarnación Fenoy[1,2], Juan Rubio-Ríos[1,2,4,5], Urtzi Arteagabeitia[3], Lucía Moya-Gordo[1], Raquel Pinto-Medina[1], Luz Boyero[3,6], J. Jesús Casas[1,2]

[1]Department of Biology and Geology, University of Almería, Almería, Spain. [2]Andalusian Centre for the Global Change – Hermelindo Castro (ENGLOBA), Almeria, Spain. [3]Stream ecology Lab. Dept. of Plant Biology and Ecology, Faculty of Science and Technology, University of Basque Country EHU, Leioa, Spain. [4]Biodiversity and Conservation Area, University King Juan Carlos, Madrid, Spain. [5]Instituto de Investigación en Cambio Global (IICG), 28933 Móstoles, Spain. [6]IKERBASQUE, Basque Foundation for Science, Bilbao, Spain

jpv687@ual.es

Invasive riparian plants can profoundly alter stream ecosystem structure and function, yet their impacts often vary across socio-environmental settings, complicating predictions of ecological outcomes and the success of restoration efforts. Here, we evaluate the effects of the highly invasive giant reed (*Arundo donax*) across four Mediterranean streams in southeastern Spain that represent a gradient of invasion status, management intervention, and land-use intensity, including a restored reach where *A. donax* had recently been removed. The study sites differ markedly in hydrology, riparian structure, catchment land use, and fragmentation, providing a robust setting for assessing context dependence in invasion outcomes. Habitat integrity was quantified by means of riparian and physicochemical metrics, whereas functional integrity (microbial and total decomposition, and periphytic algal accrual) was evaluated using leaf-litter decomposition assays (fine- and coarse-mesh litterbags containing either *A. donax* litter or a mixture of native riparian species employed in restoration programs) and periphyton accrual on marble tiles. Using a hypothesis-driven pairwise comparative framework, we disentangled the effects of invasion from those associated with restoration or broader anthropogenic pressures. After seven weeks of instream incubation, ecological responses to *A. donax* were clearly context dependent: several effects typically attributed to invasion —such as altered ecosystem functions and biotic assemblages— were only detectable under certain land-use context. Restoration efforts partially mitigated invasion impacts, although recovery trajectories were strongly constrained by local factors. Overall, our findings underscore the context-dependent nature of *A. donax* impacts and highlight the need for consistent, process-based approaches when restoring invaded stream systems and evaluating the restoration success, particularly within human-modified river networks.

Evaluating the effect of livestock exclusion in terms of carbon sequestration in mountain wetlands

Alberto Vélez Martín*, José Barquín Ortiz

IHCantabria - Instituto de Hidráulica Ambiental de la Universidad de Cantabria, 39011, Santander, Spain

alberto.velez@unican.es

Globally, peatlands are among the most efficient ecosystems for carbon storage, and this, despite their limited extent compared to other continental ecosystems, makes them priority areas for conservation and restoration in the fight against climate change. The carbon sequestration mechanisms by which these wetlands function as large carbon sinks are based on water saturation and the anoxic conditions of their soils, which slow deterioration and promote the vertical accumulation of organic matter. On the Iberian Peninsula, these habitats, already restricted to the Atlantic region and mountain refuges where climatic conditions allow for high humidity, are in an alarming state of conservation, mainly due to the effects of water abstraction, overgrazing, and climate change. One of the main measures implemented during the LIFE-DIVAQUA project (2019-24) involved installing perimeter fences around several wetlands in the Picos de Europa National Park to protect them from livestock grazing during the summer months, when these animals exert the greatest pressure as they are moved to mountain pastures. To assess the effectiveness of this measure, a field campaign was conducted during the summer of 2025 as part of the NBRACER project (2023-27) to monitor four of these temporarily or permanently fenced bogs and fens (Salgardas, Vegabaño, Pedabejo, and Vega Comeya). In addition to analyzing several physicochemical factors of the soil and water both inside and outside these fenced areas, the vegetation was characterized in terms of cover and aboveground biomass, and the concentration of greenhouse gases (CO_2, CH_4, and N_2O) was measured using sealed chambers under light and dark conditions. Apart from the multiple benefits in terms of soil protection, water quality and biodiversity, the results of this study confirm how the carbon sink function of these habitats can be enhanced thanks to the implementation of this restoration measure.

CO_2 fluxes in abandoned and restored marine saltpans

Paula Warren-Jiménez[1]*, Sofía Rodríguez-Gómez[1], Miriam Ruiz-Nieto[1], Teresa Gil-Gil[2], Enrique Moreno-Ostos[1]

[1]Universidad de Málaga, 29010, Málaga, Spain. [2]WWF/Adena, 28005, Madrid, Spain

paulawarren@uma.es

Marine saltpans are saline coastal wetlands anthropogenically modified for salt production and extraction. Despite their artificial origin, the anoxic and hypersaline conditions prevailing in their sediments, together with phytoplankton-driven primary production, suggest that saltpans may function as potential carbon sinks. However, the abandonment of salt production can alter biogeochemical processes, potentially shifting these systems from CO_2 sinks to atmospheric CO_2 sources, thereby reducing their carbon sequestration capacity. Ecological rehabilitation may help restore carbon sink dynamics and enhance the climate regulation services provided by these socio-ecosystems. During a sampling campaign conducted in April 2024, we quantified CO_2 fluxes at both the water–air and sediment–air interfaces in the Marchamalo saltpan (Murcia, southeastern Spain). First, CO_2 fluxes were compared between disturbed and non-disturbed sediments to assess the impact of management strategies. Second, CO_2 fluxes from abandoned ponds and a recently restored salt-production circuit were measured to assess the short-term effects of saltpan rehabilitation. Environmental variables including salinity, pH, temperature, sediment organic and inorganic carbon, and moisture content were measured to identify the main drivers of CO_2 exchange. Our results indicate that temperature and salinity were the main drivers of CO_2 flux variability, and that CO_2 fluxes were significantly lower in restored ponds compared to abandoned ones, suggesting a recovery of carbon sequestration potential following restoration. However, sediment disturbance associated with restoration and salt production and extraction activities resulted in higher CO_2 emissions compared to undisturbed sediments, indicating a potential impact on carbon stocks. This highlights that further investigation might be needed to identify management strategies that balance the potential carbon sequestration capacity with the operational maintenance of saltpans.

IDIAT2: Recalibration and validation of a nationwide diatom index for ecological status assessment across Spanish river typologies

Romina Álvarez-Troncoso[1]*, Mikel Zaragüeta Amondarain[2], Teresa Conejo[2], Yaiza Luque Martínez[3], Célia Laguna Mora[3], Juan Alández Rodríguez[4]

[1]University of Vigo, Campus Lagoas Marcosende, 36310, Vigo, Pontevedra, Spain. [2]Eurofins Cimera C/Santiago Grisolía, 2, Parque Tecnológico de Madrid, 28760, Tres Cantos , Madrid, Spain. [3]Tragsatec, Calle Julian Camarillo 4B, 28037, Madrid, Spain. [4]Área de Vigilancia y Control de Calidad de las Aguas Subdirección General de Protección de las Aguas Y Gestión de Riesgos, Dirección General del Agua Ministerio para la Transición Ecológica y el Reto Demográfico Plaza de San Juan de la Cruz 10. 28071 Madrid, Spain

ralvareztroncoso@gmail.com

Accurate ecological status assessment in Spain requires diatom metrics that are robust across the full range of river typologies and that show consistent pressure–response behavior under the EU Water Framework Directive. We present IDIAT2, an updated, distance-based diatom index recalibrated to be valid across all Spanish river types and suitable for intercalibration and management applications. We compiled diatom and physico-chemical monitoring data from 2018–2023 from national databases (NABIA and REFCOND), resulting in 6,640 samples from 2,641 monitoring sites. Biological quality control followed UNE-EN 13946 and UNE-EN 14407 (≥400 valves per sample), with exclusion of taxa not identified to species/infra-species level and removal of very rare counts (<3 valves), synonymy checks, and taxonomic updating using OMNIDIA. Physico-chemical variables were selected for coincident sampling periods and transformed to reduce skew (conductivity square-root; ammonium, BOD5, COD, phosphate, nitrate and dissolved oxygen log10; pH untransformed). To define reference ("image") communities and biotypes, we applied Self-Organizing Maps (SOM) in R (package diatSOM) and optimized clustering using the Davies–Bouldin index (14 initial clusters). We then implemented an automated, reproducible pruning routine based on a composite contamination score to iteratively exclude the most impacted clusters. Canonical Correspondence Analysis confirmed a dominant gradient linked to nutrients and organic enrichment and supported three reference groups: calcareous (CAL), siliceous (SIL), and the Río Tinto type (TINTO). Within each group, Correspondence Analysis positioned taxa and samples along the primary gradient; species scores were rescaled to 0.001–5 and combined with abundance- based weights to compute station values (higher scores indicate higher similarity to reference). Ecological class boundaries were derived from group-specific percentiles (reference: P90 for SIL/TINTO, P95 for CAL; High/Good: P25), with harmonization where required following CIS Guidance Document No. 30. Validation showed strong agreement with IPS (overall r = 0.75; CAL r = 0.79; SIL r = 0.72) and coherent negative relationships with nutrient/organic indicators (e.g., TOC, total N, PO4), demonstrating a robust nationwide tool for diatom-based ecological assessment.

Geosmina y *Dolichospermum crassum*, análisis de su relación por microscopía, secuenciación masiva y citometría de fluorescencia

Laura Cáceres Jiménez*, María González Lucena, David García Valenzuela

Subdirección de Calidad de las Aguas, Canal de Isabel II SA. MP. Calle Santa Engracia 125, Madrid, España

lcaceres@canal.madrid

Durante el verano de 2024 se produjo un episodio de olor asociado a elevados niveles de geosmina en el embalse de Valmayor. La importancia de este compuesto en el abastecimiento, aun sin ser tóxico, radica en su característico olor terroso, perceptible en cantidades muy bajas (5-10 ng/L). Por ello, se realizó un estudio de dicho episodio y su relación con la comunidad fitoplanctónica presente, con objeto de identificar los posibles organismos responsables de la producción de geosmina. Para ello se abordó el análisis mediante tres aproximaciones: el análisis microscópico tradicional, técnicas de secuenciación masiva de la región 16S y citometría de flujo con fluorescencia. A lo largo del evento se observó la dominancia de *Dolichospermum crassum*, tanto en términos de abundancia celular, como de biomasa estimada. Aunque no se detectaron otras especies productoras de geosmina en cantidades significativas, no puede descartarse la contribución de otros microorganismos en menor proporción. Estos resultados ponen de manifiesto la utilidad de la citometría de flujo con fluorescencia como herramienta de alerta temprana y monitorización en episodios de olor en embalses. Su combinación con técnicas moleculares y tradicionales permite una caracterización más completa de las comunidades microbianas implicadas, facilitando la toma de decisiones en la gestión del recurso hídrico. Además, la identificación de *D. crassum* como principal organismo productor de geosmina en este episodio, refuerza la necesidad de incluir esta especie en los programas de vigilancia de calidad de agua, especialmente en embalses eutrofizados susceptibles a proliferaciones de cianobacterias.

PIGMENTUM adaptation to freshwater phytoplankton communities and new diagnostic pigment ratios contributions

Alfredo Llorente[1,2]*, Sergio Seoane[2,3]

[1]Anbiotek S.L. Axpe Industrialdea, Ribera de Axpe 11 B-201, 48950 Erandio, Spain. [2]Department of Plant Biology and Ecology, Faculty of Science and Technology, University of the Basque Country EHU, 48940 Leioa, Spain. [3]Research Centre for Experimental Marine Biology and Biotechnology (Plentzia Marine Station, PiE-EHU), University of the Basque Country EHU, 48620 Plentzia, Spain

alfredo@anbiotek.com

Pigment-based chemotaxonomy relies on mathematical models to estimate the contribution of phytoplankton groups from diagnostic pigment composition. Most existing approaches, however, were developed for marine communities, and the availability of freshwater-specific pigment ratios remains limited. Here, we present a freshwater adaptation of the PIGMENTUM method (Bilbao and Seoane 2024), reformulating the original blocks of equations to accommodate the taxonomic and pigment diversity of freshwater phytoplankton. In addition, the model incorporates refinements to the original formulation, including a revised computation of the similarity percentage between estimated and observed chlorophyll a (Sim%), an alternative procedure for dominance correction at the community level, and a new feature for field ratio calculation. This adaptation is underpinned by new pigment ratio contributions derived from algal cultures, comprising 51 freshwater taxa (102 strains), which are complemented with published sources to improve representativeness across major phytoplankton groups. Using a dataset of 190 samples collected from different lentic freshwater ecosystems spanning a range of trophic states, model performance was evaluated using Sim%. The median value for the whole dataset was 85.5%, indicating low global deviation. Sim% values were consistent across sampling depths but differed between ultraoligotrophic (77.3%) and eutrophic (91.5%) conditions. External assessment against taxonomic biovolumes showed high agreement for cyanobacteria, chlorophyll b–containing algae (CbCA) and cryptophytes (R^2 = 0.70–0.94), whereas moderate agreement was observed for dinoflagellates and fucoxanthin-containing algae (FCA) (R^2 = 0.46–0.59). Consistently, signed error distributions between techniques were low for cyanobacteria (2.26%), CbCA (2.96%) and cryptophytes (0.47%), while larger deviations were observed for dinoflagellates (−3.02%) and FCA (10.50%). When applicable, field ratios maintained or improved agreement with taxonomic estimates. Overall, this adaptation extends the applicability of PIGMENTUM to freshwater phytoplankton communities, providing a simple and internally consistent tool particularly suited to freshwater monitoring programmes.

Estimating community size spectra from taxonomic identity

Ekain Lopez Fraile[1]*, Daniel Perkins[2], Aitor Larrañaga[1]

[1]Euskal Herriko Unibertsitatea, 48940 Leioa, Bizkaia, Spain. [2]Brunel University of London, Kingston Lane, Uxbridge, UB8 3PH, United Kingdom

ekain.lopez@ehu.eus

Body size distributions capture essential features of ecological community structure and are tightly linked to energy fluxes, trophic interactions, and ecosystem functioning. In freshwater macroinvertebrate communities, the size spectrum slope is a widely used indicator of ecological health. However, its estimation typically requires measuring the body size of every sampled individual, a labour-intensive step that constrains its use in ecological studies. Here we evaluate an alternative approach in which individual sizes are inferred from external datasets based on taxonomic identity rather than measured directly. Using European-scale datasets of freshwater invertebrate body sizes, we compared size-spectrum slopes derived from traditional measurement-based data with those obtained through taxonomic extrapolation. We applied a Bayesian hierarchical latent-variable model to quantify the additional uncertainty introduced by the extrapolation procedure. Our results show that extrapolated estimates can approximate measurement-based size-spectrum slopes reliably when external datasets originate from geographically proximate sites with similar environmental characteristics. These findings highlight both the promise and limitations of taxonomic-identity-based size estimation for broad- scale ecological studies.

Satellites uncover long-term water colour patterns in Pyrenean high mountain lakes

Camille Minaudo[1]*, Laura de Breuck[2], Tatiana Bello[3], Núria Catalán[4], Marti Navarro[2], Mariella Olcese[1], Sílvia Pardó[5], Lluís Pesquer[6], Anna Ticó[7,1], Quirin Woerl[2], Lluís Camarero[4], Lluís Gómez[2]

[1]Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Universitat de Barcelona (UB), Barcelona, Spain. [2]Department of Geosciences, Institute of Environmental Assessment and Water Research (IDAEA-CSIC), Barcelona, Spain. [3]Departamiento de Ecologia, Universidad de Granada (UGR), Granada, Spain. [4]Centre d'Estudis Avançats de Blanes (CEAB-CSIC) Blanes, Girona, Spain. [5]Universitat Autonoma de Barcelona (UAB), Barcelona, Spain. [6]GRUMETS research group. Centre for Research on Ecology and Forestry Applications (CREAF), Cerdanyola del Vallès, Barcelona, Spain. [7]Centre for Research on Ecology and Forestry Applications (CREAF), Cerdanyola del Vallès, Barcelona, Spain

camille.minaudo@ub.edu

High-mountain lakes are sensitive indicators of climate and land-use change, integrating natural and anthropogenic perturbations through physical, biogeochemical, and biological processes. Water colour provides an integrative signal of these processes, responding to variations in optically active constituents such as phytoplankton pigments, dissolved organic matter, and suspended mineral particles. Satellite remote sensing enables multi-decadal monitoring of lake colour at regional scales; however, long-term analyses remain challenged by differences among satellite sensors. Here, we investigate long-term changes in lake water colour and water quality across the Pyrenean lake district, focusing on 758 high-mountain lakes larger than 1 ha. By harmonizing water-leaving reflectance observations from Landsat 7 to 9, and Sentinel-2 MSI, we derived optical indicators including dominant wavelength (DWL) and the Forel–Ule Index (FUI) for the period 1999–2026, representing nearly 700,000 reflectance observations. Lake colour metrics were interpreted within a trophic-state framework to explore potential shifts toward greener (eutrophication-driven) or browner (organic-matter-driven) conditions. Whenever available, remotely sensed lake-colour data were combined with in situ water-quality measurements (520 sampling dates across 119 lakes), including dissolved organic carbon and nutrient concentrations. Spatial overlap occurred for 145 lakes, with 86 temporal matchups (±7 days) across 18 lakes. Preliminary results indicate that, over the past decade, 83% of Pyrenean lakes are optically blue (DWL < 500 nm; FUI < 7), while the remainder range from green to yellow. The bluest lakes exhibit the largest seasonal DWL variability, whereas greener lakes show more stable colour conditions. Long-term analyses reveal that most lakes show no significant trends, although 52 lakes display significant greening trends and nine show bluing trends. These results demonstrate the potential of harmonized satellite observations to reveal long-term spatiotemporal patterns in lake optical properties, highlighting the value of remote sensing for monitoring environmental change in data-scarce high-mountain lake ecosystems.

Virtual Watersheds of Spain (VIEWS-ES): A digital database platform for fluvial research and freshwater management

Francisco J. Peñas*, María Moran-Luis, Alejandra Goldenberg-Vilar, Mario Alvarez- Cabria, Alexia M. Gonzalez-Ferreras, Ignacio Perez-Silos, José Barquín

IHCantabria – Instituto de Hidráulica Ambiental de la Universidad de Cantabria, Spain

penasfj@unican.es

Freshwater ecosystems are increasingly threatened by accelerating human pressures and climate change. Yet translating the best available science into effective river basin management remains constrained by fragmented, heterogeneous or low-resolution environmental data. To overcome this limitation, we present the Virtual Watersheds of Spain (VIEWS-ES), a comprehensive digital platform designed to support fluvial research and integrated catchment management. Following the virtual watershed framework, which couples high-resolution algorithmic hydrography with terrestrial landscape elements, VIEWS-ES provides a spatially continuous and attributed digital riverscape for 15 river basin districts in mainland Spain. The database is structured around a synthetic river network comprising more than 430.000 hydrologically connected reaches, with an average reach length of 1.171 meters. This network was delineated from a 5 meters digital elevation model and harmonized with the official vector hydrography from the 1:25.000-scale Topographic Nacional Map (MTN25), which served as the reference network to ensure spatial accuracy and cartographic consistency. Each reach is linked to a rich set of hydro-environmental attributes, including topography, climate, geology, land use and land cover, and anthropogenic pressures such as dams, weirs, and wastewater discharges. A core strength of VIEWS-ES is that it relies exclusively on official and publicly available data sources from national or regional institutions (e.g., MITECO, IGME, CNIG, river basin authorities), ensuring territorial homogeneity, consistency and administrative alignment. Importantly, the platform incorporates full upstream–downstream routing of environmental information, enabling multi-scale aggregation of attributes from local drainage areas and 200 meters riparian buffers to entire upstream catchments. By integrating these diverse datasets into a homogeneous, reach-level structure, VIEWS-ES represents a significant evolution from traditional cartographic hydrography, offering a powerful tool for addressing current ecological and resource management challenges at a national scale. For instance, this platform enables advanced spatial analyses and modelling, ecological forecasting, and evidence-based water resource and conservation planning.

Construction of area-weight relationships for estimating the mass of fluvial macroinvertebrates

Iria Río Lado*, Mario Álvarez-Cabria, José Barquín

Instituto de Hidráulica Ambiental de la Universidad de Cantabria

iria.rio@unican.es

Knowing the biomass of the different biological communities that make up ecosystems is essential for modelling matter and energy flows. In the case of river ecosystems, a key community is the benthic macroinvertebrate community since energy flows through them from basal resources to fish and other vertebrates. Because traditional techniques for estimating the biomass of benthic macroinvertebrates (drying, ashing, weighing) are laborious and destructive, the use of allometric relationships based on power laws ($M=a \cdot L^{\wedge b}$) has become the most accurate and widely established alternative. However, this method is often inefficient because it takes a long time to take measurements of each individual. This study proposes an automatable and non-destructive methodology that significantly reduces sample processing time. Based on the allometric length-dry weight equations, a new relationship between biomass (i.e., dry weight) and projected body area of invertebrates is derived, obtained through image analysis with Fiji software. Results showed coefficients of determination greater than 0.85 in 85% of the regressions developed for each family, so the incorporation of the projected body area is shown to be a robust predictor of invertebrate biomass. This approach therefore offers a replicable and simple alternative for obtaining biomass data for these key communities in river ecosystems.

Fine-scale hydrological heterogeneity in temporary aquatic habitats: evidence from a Bayesian remote-sensing framework

Carlota Solano-Udina[1]*, Eduardo M. García-Roger[1], Anabel Forte[2], Javier Montero-Pau[1], María José Carmona[1]

[1]Unitat d'Ecologia Evolutiva, Institut Cavanilles de Biodiversitat i Biologia Evolutiva, Universitat de València, Burjassot, Spain. [2]Department of Statistics and Operational Research, Universitat de València, Burjassot, Spain

carlota.solano@uv.es

Mediterranean shallow ponds are characterized by abrupt wet-dry transitions occurring over short time scales, strongly influencing organisms that inhabit them, which must synchronize their life-history events with brief periods of favourable conditions. However, capturing this fine-scale hydrological variability remains challenging. Although remote sensing offers long-term, standardized time series, satellite data often misclassify short inundation events or miss rapid drying phases – especially in small, shallow systems. Here, we developed a Bayesian state-space approach to curate Sentinel-2 time-series data, improving hydrological state detection in a system of ponds in the eastern Iberian Peninsula. Correcting primarily false water detections allowed to reconstruct a hydrological time series that more accurately reflect real inundation dynamics. Using this curated data, we quantified the non-permanent character of these ponds through ecologically meaningful metrics, revealing substantial differences in temporal variability and predictability among neighbouring ponds exposed to similar regional climatic conditions. Our results highlight that ecological heterogeneity can emerge at very small spatial scales. As a proof of concept, we further demonstrate the evolutionary ecological relevance of these hydrological metrics by linking environmental unpredictability to bet-hedging strategies in rotifer populations. Rotifers originating from more unpredictable ponds exhibited stronger risk-spreading strategies, consistent with adaptation to unpredictable environments. Overall, this study underscores that understanding temporary aquatic ecosystems requires aligning environmental characterization with the temporal scales at which ecological processes unfold.

A modeling framework for multifunctional ecosystem restoration: managing ecosystem services trade-offs in the Albufera lagoon (Valencia, Spain)

Pablo Amador[1]*, Lorraine Maltby[2], Andrew Beckerman[2], Antonio Camacho[1], Andreu Rico[1]

[1]Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, c/ Catedrático José Beltrán 2, 46980, Paterna, Valencia, Spain. [2]School of Biosciences, University of Sheffield, Sheffield S10 2TN, United Kingdom

pablo.amador@uv.es

Aquatic ecosystems sustain a wide range of services that underpin human well-being, from food and freshwater to climate regulation. Yet these systems are increasingly compromised by multiple stressors, particularly in Mediterranean coastal wetlands, where nutrient enrichment and pesticide loads have led to severe ecological degradation. This deterioration not only threatens biodiversity but also undermines the social and economic benefits these ecosystems provide. Recent policy frameworks call for approaches that explicitly link ecological processes with service provision, recognising that conventional risk assessments fail to capture ecosystem complexity. Here we provide a quantitative framework to assess the implications of different ecosystem management measures on the ecological status and the ecosystem services provided by a protected Mediterranean wetland, including their associated economic value. The framework was underpinned by process-based model (AQUATOX) that was used to simulate the impact of nutrient (N and P) and pesticide input reduction on the ecological dynamics of the Albufera Lagoon (Valencia, Spain). We show that reductions in nutrient and pesticide inputs generate distinct ecological states that differ markedly in their capacity to sustain multiple ecosystem services. Six alternative aquatic community configurations emerged, primarily driven by phosphorus limitation and by the fungicide azoxystrobin, each associated with characteristic bundles of ecosystem services. Cultural and regulating services such as tourism, carbon sequestration, and phosphorus retention increased under low-nutrient, low-toxicity conditions, whereas provisioning services (i.e commercial fishing) declined. Our results demonstrate that nutrient control alone does not secure ecosystem recovery as pesticides interact with eutrophication to produce non-linear and sometimes counterintuitive responses. By explicitly quantifying the links between ecological change and service delivery, this study provides a transferable framework for integrating risk assessment and ecosystem-based management, guiding the design of restoration strategies that enhance multifunctionality in human-dominated wetlands.

Environmental monitoring plan for the renaturalisation of a storm overflow infrastructure on the Manzanares River, Madrid

Francisco Cortés*, María Díaz-Redondo, Manuel García, Sergio Ibarra, Elena Medina

Centro de Estudios de Técnicas Aplicadas (CETA), CEDEX, C/ Alfonso XII, 3-5, 28014, Madrid, Spain.

Francisco.m.cortes@cedex.es

The “Restoration of the Manzanares–Gavia–Bulera Fluvial Ecosystem” project, part of the green and blue infrastructure of Madrid’s Metropolitan Forest, aims to develop a renaturalisation strategy for the Manzanares River to recover its ecological values and the ecosystem services it provides. Its purpose is to promote a more natural functioning of the river in balance with its urban surroundings, enhancing resilience to pressures and impacts derived from human activities. To achieve this, the project incorporates a comprehensive and ambitious monitoring plan coordinated by the Centre for Studies and Experimentation of Public Works (CEDEX), which includes systematic measurement of indicators throughout all its phases: baseline, during the construction, and after the implementation of the solutions. This monitoring is based on multiscale data collection covering key elements of the fluvial ecosystem, such as riparian vegetation, land uses, entomofauna, and ichthyofauna. From this information, indicators are generated to evaluate relevant ecosystem services and to determine the effectiveness of renaturalisation actions. Preliminary analyses reveal low hydromorphological quality, limited lateral connectivity of riparian vegetation, and low values for biological quality element indicators. The monitoring plan, therefore, aims to serve as a guide for assessing the performance of the Nature-Based Solutions implemented in the river ecosystem, and assisting in its enviromental management through an adaptive approach.

Impacts of aquatic recreational activities on fluvial ecosystems and implications for management strategies

Anna Freixa[1]*, Vicenç Acuña[1], Neus Besolí-Mestres[1], Clara Soler[2], Ada Pastor[2], Laura Guerrero[3], Anna M. Romaní[2], Josep Pueyo-Ros[1]

[1]Catalan Institute for Water Research (ICRA), Carrer Emili Grahit, 101, Parc Científic i Tecnològic de la Universitat de Girona, 17003, Girona, Spain. [2]Institut d'Ecologia Aquàtica, Universitat de Girona (UdG). [3]Molecular Microbial Ecology Group, Institute of Aquatic Ecology, University of Girona (UdG)

afreixa@icra.cat

Rivers play a critical role in maintaining biodiversity, regulating hydrological processes, and providing high-quality water and essential ecosystem services. Recent increases in aquatic recreational activities, including swimming and canyoning, have intensified pressures on fluvial ecosystems, particularly during low-flow periods when habitat availability is limited, and organisms rely on restricted refuge areas. We assess the effects of recreational use on water quality and microbial biofilm composition across rivers experiencing varying levels of human visitation. Our findings indicate that recreational activities affect water quality, with elevated levels of contaminants linked to human presence, including personal care products that pose potential ecotoxicological risks to aquatic life. Bacterial communities also showed measurable shifts, reflecting the influence of anthropogenic disturbance on microbial biodiversity. Moreover, the ecological effects of aquatic recreational activities may be confounded with other anthropogenic stressors, such as wastewater treatment plant effluents, which can further increase contaminant loads and amplify ecological impacts. To support sustainable management, we also propose a prioritisation framework integrating empirical ecological data with structured evaluation of management measures. This approach combines ecological indicators, spatial assessment of recreational pressures, and multi-criteria prioritisation to identify and rank management actions based on expected effectiveness and implementation feasibility. Our results provide crucial guidance for conserving biodiversity, mitigating anthropogenic impacts, and ensuring the long-term ecological functioning of river ecosystems under increasing recreational pressures.

Riparian LULC in the river Ave Basin (NW Portugal): Linking Sentinel-2 Imagery and InVEST to Support Ecosystem Services Mapping

Henrique Alves, Margarida Araújo, Cláudia Carvalho-Santos

Centre of Molecular and Environmental Biology (CBMA)/Aquatic Research Network (ARNET) Associate Laboratory, Institute of Science and Innovation for Bio-Sustainability (IB-S), Department of Biology, University of Minho, 4710-057, Braga, Portugal

b14914@bio.uminho.pt

Riparian ecosystems are critical ecological buffers that sustain habitat connectivity, biodiversity and many ecosystem services such as water purification. However, they are highly vulnerable to urbanization, intensive agriculture and exotic species invasions, challenging the objectives of the EU Water Framework Directive (WFD). In the Rio Ave basin (NW Portugal), historically marked by intensive anthropogenic pressures, mainly due to textile industries and intensive dairy production, spatially explicit information on riparian land use and land cover (LULC) is essential to identify pressures and prioritize restoration to improve ecosystem services provision. Therefore, the main goal of this study was to map riparian zones along the Ave, Este, Selho and Vizela rivers using a supervised classification of 2024 Sentinel-2 imagery in Google Earth Engine to serve as a more accurate basis for ecosystem services mapping. For this, we defined nine LULC classes: Urban, Water, Annual Agriculture, Permanent Agriculture/Agroforestry Complexes, Vineyard, Eucalyptus, Acacia, Native Forest and Shrubland. Following field validation, the resulting high-resolution LULC layer was first integrated with an extensive biodiversity occurrence database for the basin to understand how the riparian LULC will impact the riparian biodiversity and habitat quality. Moreover, other ecosystem services were mapped, namely soil erosion control, carbon storage, water yield and purification using InVEST tool, comparing our LULC map from Sentinel-2 and traditional LULC map. Results indicate that the use of more spatially defined LULC maps improve ecosystem services mapping compared with traditional LULC maps. Riparian areas dominated by native forest remnants support higher species richness and ecosystem services provision than riparian areas dominated by urban, intensive agriculture or exotic trees of *Acacia* spp. and *Eucalyptus globulus*. By quantifying the spatial extent and configuration of these pressures, particularly the expansion of invasive *Acacia* and intensive agriculture, this work shows how satellite derived LULC are important to identify priority riparian sites for conservation and restoration of biodiversity and ecosystem services, especially under the new Restoration Law implementation.

Freshwater ecological quality and urbanization are linked to human health: evidence from a multiscale pan-European study

Janine Pereira da Silva[1]*, Sónia R.Q. Serra[1], Ana Raquel Calapez[1], Ângela Freitas[2,3], Carina Dantas[2,4], Maria João Feio[1]

[1]MARE – Marine and Environmental Sciences Centre / ARNET—Aquatic Research Network, Department of Life Sciences, Faculty of Science and Technology, University of Coimbra, Portugal. [2]SHINE 2Europe, Lda, Coimbra, Portugal. [3]CEGOT–Centre of Studies in Geography and Spatial Planning, University of Coimbra, Coimbra, Portugal. [4]Institute for the Biomedical Sciences Abel Salazar, University of Porto, Portugal

janinepdasilva@gmail.com

Freshwater ecosystems host a disproportionate biodiversity and provide essential services for human populations, yet their condition continues to decline. In cities, where most of the world's population lives, the quality of rivers and streams has the potential to improve human mental and physical health, but ongoing urban expansion poses many environmental and health challenges. Despite the known links between nature and human health, evidence linking freshwater ecosystem quality and urbanization to public health remains scarce. Within the OneAquaHealth project (https://www.oneaquahealth.eu/), we analyzed ecological quality assessments of more than 16,000 surface freshwater bodies, urban land-use intensity, and 18 human health outcomes across Europe. Poorer ecological status was consistently associated with lower life expectancy and increased mortality from digestive, endocrine, metabolic, circulatory and cancer-related diseases, as well as intentional self-harm. These relationships persist after accounting for socioeconomic conditions, indicating robust and independent associations. Urbanization exhibits outcome- specific relationships, emphasizing the importance of disentangling its effects from ecosystem status. Infectious diseases showed the weakest associations with ecological status and urbanization, likely reflecting data limitations. Given the consistency and scale of our findings, this study demonstrates the co-benefits of promoting ecosystem health and human health, highlighting the importance of the One Health framework. The ecological monitoring of freshwater ecosystems provides a unique opportunity to use standardized indicators as early- warnings of public health risks.

When the river turns salty: impacts on human-river relationships in The Gambia

Pablo Rodríguez-Lozano[1]*, Ana E. Solórzano Ruiz[2], Kim Peris Fons[1,2], Fatoumata Marong[3], Abdoulie Camara[4], Faback Gibba[5], Diego Sanz Yus[2], Isabel Ruiz-Mallén[6], Elena Ojea[7], Núria Catalán[8], Miguel Cañedo-Argüelles[2], Fabakary Daffeh[5]

[1]Inland-Water Ecosystems Team (I-WET), Departamento de Ecología, Universidad Autónoma de Madrid, Madrid 28049, Spain. [2]Institut de Diagnòstic Ambiental i Estudis de l'Aigua (IDAEA-CSIC), 08034 Barcelona, Spain. [3]Gambia Environmental Alliance & CAPED Gambia. [4]Department of Forestry, Ministry of Environment Climate Change and Natural Resource (MECCNAR), Abuko, The Gambia. [5]Department of Humanities and Social Sciences, Development Studies Unit, University of The Gambia, Serrekunda, The Gambia. [6]Faculty of Psychology and Education Sciences & TURBA Lab, Universitat Oberta de Catalunya (UOC), Barcelona, Spain. [7]Centro de Investigación Mariña (CIM) - Future Oceans Lab, Universidade de Vigo, Spain. [8]Centre d'Estudis Avançats de Blanes (CEAB-CSIC) Blanes, Girona, Spain

pablo.rodriguezlozano@uam.es

Seawater intrusion driven by global change is a growing global concern, with significant consequences for both ecosystems and human communities. In The Gambia, where local communities strongly depend on the River Gambia, saline water has advanced up to 250 km upstream, creating a complex socio-ecological challenge. In this context, this study examines how seawater intrusion impacts riverine communities and reshapes their relationships with the river. We adopt the IPBES framework, which places Nature's Contributions to People (NCPs) at its core, encompassing both positive and negative contributions of ecosystems to human well-being. At the same time, the IPBES framework is grounded in the concept of multiple values, which recognizes not only instrumental values, but also intrinsic and relational values. Building on this perspective, we first characterize the relationships between local communities and the River Gambia in terms of NCPs and multiple values, and then assess how seawater intrusion is affecting these relationships. Empirically, we conducted 90 semi-structured interviews across nine communities distributed along the salinity gradient. Our results highlight the diversity of relationships between the River Gambia and local communities, reflected in a wide array of NCP and multiple values. Seawater intrusion is severely affecting material NCP, particularly food provision, through its impacts on fish communities and freshwater availability for rice farming. Freshwater provision for drinking and hygiene is also increasingly compromised. Beyond material benefits, the River Gambia sustains non-material contributions and relational values, including local identities, meaningful occupations, sense of place, and social cohesion. As salinization progresses, its impacts extend beyond food and water insecurity, generating psychological distress and a perceived erosion of relational ties to the river. Overall, our findings reveal that seawater intrusion is not only altering ecological processes and material benefits, but also reshaping the multiple values that underpin human–river relationships in The Gambia.

Valuing ecosystem services in Portuguese urban streams: how much are people willing to pay?

Maria Carolina Sousa[1,3,6]*, Rita Martins[1,5,] Paula Simões[2,5], Nuno Simões[1,6], Maria João Feio[1,3,4]

[1]University of Coimbra, Paço das Escolas, Coimbra, Portugal; [2]Polytechnic Institute of Leiria, Rua General Norton de Matos, 4133, Leiria, Portugal; [3]Marine and Environmental Sciences Centre - MARE, Rua da Matemática, 49, Coimbra, Portugal; [4]Aquatic Research Network – ARNET, Rua da Matemática, 49, Coimbra, Portugal; [5]Centre for Business and Economics Research - CeBER, Avenida Dr. Dias da Silva, 72, Coimbra, Portugal; [6]Institute for Systems Engineering and Computers at Coimbra – INESCC, Rua Sílvio Lima, Pólo II, Coimbra, Portugal.

mccds@student.dec.uc.pt

Freshwater ecosystems and their ecosystem services (ES) are fundamental to city sustainability and human well-being, yet highly vulnerable to the effects of urbanisation. This study estimates the willingness to pay (WTP) for the maintenance and enhancement of regulating ES (air quality and climate regulation; water quality and flood mitigation; carbon sequestration and pollination) provided by two urban streams (Vale das Flores and Eiras) in Coimbra, Portugal. A total of 260 individuals completed one of the six questionnaire types (according to the stream site and the pair of ES evaluated). The questionnaire was designed to collect data for the application of the Contingent Valuation Method (CVM) and the analysis employs a two-part model: a Logit model to estimate the probability of a positive WTP, and a Generalised Linear Model (GLM) with Gamma distribution to estimate mean WTP values. Robustness tests were performed to confirm model consistency. Pro-environmental attitudes are positively associated with willingness to contribute, whereas the unwillingness to pay is associated with perceived governmental responsibility for funding the project. The mean conditional WTP over a two-year period is positive, ranging from 33.8 EUR (carbon sequestration and pollination at Eiras) to 64.7 EUR (carbon sequestration and pollination at Vale das Flores), with consistently higher values for Vale das Flores. Determinants of WTP values vary by local context: Attitudinal ES index and Education level are positively and significantly associated with Vale das Flores, whereas gender and income are significant for Eiras. The overall probability of a positive WTP is estimated at 45%. This study contributes to enriching the literature on freshwater ES valuation, underscores the importance of accounting for expectations and perceptions when designing interventions to maintain and enhance urban stream ES, and provides empirical support for the integration of economic valuation into environmental decisions.

Assessing vegetation net primary production in a large subtropical wetland from remote sensing data

Matheus Henrique Tavares*, David da Motta Marques, Rafael de Albuquerque Cavalcanti, Mariê Mello Cabezudo

Instituto de Pesquisas Hidráulicas, Universidade Federal do Rio Grande do Sul, 91501-970, Porto Alegre, Brazil

tavaresmatheush@gmail.com

Macrophytes are an important component of aquatic ecosystems and especially in wetlands, providing important ecosystem services. Measuring their ecological importance, for instance for conservation efforts, is a complex task, but their primary production can be used as a proxy. We modelled 25 years of net primary production (NPP) of vegetation of the Taim Ecological Station, a wetland with an area of 169 km2 and high ecological importance such as sheltering migratory birds. We used an adapted version of a light-use efficiency model to estimate NPP from Landsat 5/8 images, where NPP is the product of light-use efficiency and photosynthetically available radiance (PAR). The former is estimated from water stress, temperature stress, and vegetation type. PAR and the fraction of PAR absorbed by vegetation were adopted from MODIS images. To apply the model, first the flooded area was estimated from MNDWI and removed from each date. The results showed coherent values, in accordance with the literature, with the seasonal mean NPP varying from 3-30 gC/m^2 in winter to 37-108 gC/m^2 in summer. NPP was also validated qualitatively during the wildfires that took place in December 2022, with NPP decreasing to less than 10 gC/m^2 in the majority of the wetland, but showing relatively quick recovery, with most areas increasing NPP to 40-70 gC/m^2 after one month. A Random Forest model was developed to assess the most important factors influencing NPP. Temperature (mean and maximum) was the most important factor, as expected, followed by precipation and water level. Land use in the lake watershed had also relative importance, such as area of soy crops. This work helps to better understand the dynamics of NPP in this system and to plan managing practices.

Da seca prolongada à transferência de agua interbacias: evidências de aumento da biomassa de cianobactérias e de cianotoxinas em um reservatório tropical semiárido

José Etham de Lucena Barbosa[1]*, Juliana dos Santos Severiano[2]

[1]Programa de Pós-Graduação em Ecologia e Conservação, Departamento de Biologia, Centro de Ciências Biológicas e da Saúde, Universidade Estadual da Paraíba, Campus I, Rua Baraúnas, 351, Bodocongó, Campina Grande, PB, CEP 58429-500, Brasil. [2]Departamento de Biologia, Universidade Estadual de Maringá, Avenida Colombo, 5790, Jardim Universitário, Maringá, Paraná, CEP 87020-900, Brasil.

ethambarbosa@servidor.uepb.edu.br

A expansão global dos projetos de transferência de águas interbacias (TAIBs) tem gerado crescente preocupação quanto aos seus impactos ambientais sobre os ecossistemas aquáticos receptores, especialmente em regiões semiáridas com limitação hídrica. Utilizando uma série temporal de longa duração e alta frequência amostral, investigamos a dinâmica de cianobactérias e cianotoxinas em um reservatório que recebe água do Projeto de Integração do Rio São Francisco (Brasil). Após o início da transferência de água, a biomassa de cianobactérias aumentou de forma expressiva, eventos do Nível de Alerta 2 da OMS (biomassa > 10 mg L^{-1}) tornaram-se mais frequentes, houve mudança na dominância das espécies e elevação das concentrações de microcistinas, saxitoxinas e cilindrospermopsinas. Oito espécies de cianobactérias foram registradas exclusivamente após a transferência, incluindo *Dolichospermum circinale*, um táxon potencialmente tóxico que formou densas acumulações superficiais. Essas mudanças estiveram associadas ao aumento da disponibilidade de nutrientes (particularmente fósforo total e nitrato), maior turbidez e variações no volume hídrico do reservatório. A transferência teve início durante um período de seca prolongada e coincidiu com a retomada subsequente das chuvas sazonais, indicando que as alterações observadas refletem os efeitos combinados da TAIB como um distúrbio inicial e da recuperação hidrológica, que amplificou o desenvolvimento das florações. Nossos resultados destacam a importância de interpretar os impactos da transferência interbacias dentro de seu contexto hidroclimático e reforçam a necessidade de manejo adaptativo e monitoramento contínuo para mitigar riscos toxicológicos em sistemas semiáridos vulneráveis.

Another piece of the puzzle of hidden biodiversity of *Triops* genus in the Iberian Peninsula

Dani Boix[1]*, Jordi Sala[1], Federico Marrone[2], Ferran Palero[3], Francesc Mesquita-Joanes[3], Jesús Díaz-Rodríguez[4], David Cunillera-Montcusí[5], Antonio Pradillo[6], María Sahuquillo[7], Luca Vecchioni[2]

[1]GRECO, Institute of Aquatic Ecology, University of Girona, Girona, Spain. [2]University of Palermo, Department of Biological, Chemical and Pharmaceutical Sciences and Technologies (STEBICEF), Palermo, Italy. [3]Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, València, Spain. [4]Institute of Natural Resources and Agrobiology of Seville, Spanish National Research Council (IRNAS-CSIC). Sevilla, Spain. [5]IFREMER–DYNECO/LEBCO, Centre de Bretagne. France. [6]Centro Acuícola El Palmar, Vaersa / Generalitat Valenciana. Tancat de les Rates,València, Spain. [7]Dirección General Medio Natural y Animal, Generalitat Valenciana, Valencia, Spain

dani.boix@udg.edu

The Iberian Peninsula is recognised as an area of high biodiversity for the genus *Triops*, with up to four endemic species known to exist therein. However, genetic studies performed at the beginning of the 21st century focused on the south of the Peninsula, and subsequent studies revealed that the diversity and distribution of Iberian *Triops* is not fully known. This study analyses molecular data (fragments of the mitochondrial DNA marker MT-CO1) obtained from 16 previously unanalysed Iberian *Triops* populations. We constructed a phylogenetic tree incorporating these new data alongside those of 26 additional populations from the Iberian Peninsula and the western Mediterranean region, obtained from GenBank. We observe a distinct and still unnamed MT-CO1 lineage along eastern Iberia, from southern Catalonia to the central Valencia region. This lineage is genetically more than 5% distant from its closest (sister) species, *T. simplex*, which is found in North Africa. Considering the degradation and disappearance of temporary ponds in the Iberian Peninsula and throughout Europe, and the resulting concern for the conservation of large branchiopods, our aim is to emphasise the urgent need to solve the 'Iberian *Triops* puzzle'. Such efforts are essential to deepening our understanding of this genus's biodiversity and distribution, both of which are vital for developing effective conservation strategies. In this regard, preserving existing populations and their habitats, whether natural or man-made and located in either urban or rural areas, could benefit other groups associated with temporary ponds. Thus, the presence of *Triops* can be leveraged to foster the conservation of these threatened habitats in the Iberian Peninsula.

Metacommunities of aquatic fauna associated with rock pools

Carla Olmo[1]*, Dani Boix[2], Jordi Sala[2], Sofía Suñol[2], Stéphanie Gascón[2]

[1]Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, València, Spain. [2]GRECO, Institute of Aquatic Ecology, University of Girona, Girona, Spain

carla.olmo@uv.es

Temporary lentic environments include rock pools, defined as depressions in rocky outcrops that intermittently retain water. These habitats occur across all major biomes and support relatively simple communities and trophic networks, making them attractive model systems for ecological research. Owing to the rapid life-cycle adaptations and short generation times of their inhabitants, rock pools provide valuable opportunities to test ecological hypotheses at evolutionary, population, community, and metacommunity levels. Moreover, these aquatic systems allow both in situ and experimental studies addressing the effects of hydroperiod on biota and on metacommunity dynamics. They host iconic taxa of temporary waters, including large branchiopods, odonates, coleopterans, and microcrustaceans, among others. Rock pools may occur in isolation from other water bodies, in clusters of rock pools, or be associated with others water bodies as temporary rivers, where, during drought periods, the dry riverbed retains water only in scattered depressions (potholes). The aim of this study was to investigate the taxonomic diversity of microcrustaceans and rotifers in two clusters of rock pools: one associated with a riverbed in València province and another isolated from any other water body in Lleida province. For each group, metacommunity structure was analysed, and potential relationships between aquatic communities and environmental conditions were assessed. Beyond these objectives, this study seeks to highlight and emphasize a frequently overlooked yet widespread habitat within the Mediterranean basin.

Tiny but mighty: the trophic role of *Hemidiaptomus roubaui* (Richard, 1888) (Copepoda: Calanoida) in Mediterranean temporary ponds

Jordi Sala*, Dani Boix, Anna Equisuany, Xavier D. Quintana, Stéphanie Gascón

GRECO, Institute of Aquatic Ecology, University of Girona, Girona, Spain

js.genoher@gmail.com

Hemidiaptomus is an emblematic genus associated with temporary ponds, characterized by an ancient evolutionary origin and high conservation value. Although its predatory behavior has been previously described, its functional role within trophic networks remains poorly understood. In this study, we applied a recently developed isotopic-network approach that provides quantitative metrics describing species' roles within food webs based on stable isotope data. We investigated the trophic role of *Hemidiaptomus roubaui* (Richard, 1888) using stable isotope analysis ($\delta^{15}N$ and $\delta^{13}C$) in two Mediterranean temporary pond clusters: 12 ponds in Albera piedmont (NE Iberian Peninsula) and 11 ponds in Giara di Gesturi plateau (Sardinia, Italy). Despite contrasting environmental conditions, all ponds showed good conservation status, with community richness ranging from 62 to 98 taxa, from rotifers to amphibians. $^{H.\ roubaui}$ occurred in approximately 60% of the ponds in each cluster but represented a very small fraction of total biomass (0.04–9.41%). Nevertheless, when present, it consistently occupied high trophic positions: its $\delta^{15}N$ values were above the 75th percentile in 93% of ponds and were the highest in 57% of them. In addition, *H. roubaui* exhibited high values of the betweenness metric in the isotopic-networks (above the 75th percentile in 64% of ponds), indicating a key role as a connector in energy transfer across trophic pathways. Overall, our results show that this iconic inhabitant of Mediterranean temporary ponds, despite its small size and low population biomass, plays a disproportionate role in trophic networks, acting both as a top predator and as a crucial stepping stone for energy flow.

Genetic analisis of mitocondrial Cytochrome Oxidase I support genus differentiation between *Chirocephalus* and *Galaziella*

Marc Ventura Marc[1]*, Miguel Alonso[2]

[1]Centro de Estudios Avanzados de Blanes, CSIC, 17300, Blanes, Cataluña, España. [2]Faculty of Biology, University of Barcelona, 08028, Barcelona, Cataluña, España

ventura@ceab.csic.es

The taxonomy of the family Chirocephalidae (Anostraca, Branchiopoda, Crustacea) is not fully resolved. The genus *Galaziella* was described by Naganawa & Orgiljanova, 2000 as a separate genus from *Chirocephalus* Prevost, 1803. Later it was proposed to be integrated within the larger genus *Chirocephalus* based on morphological characters. In this study we analysed different genus within the family Chirocephalidae with the mitochondrial marker Cytochrome Oxidase I (COI) in order to clarify whether the genus *Galaziella* is genetically separated from *Chirocephalus*. Comparing different families of anostraca (Chirocephalidae, Thamnocephalidae, Branchinectidae and Artemidae) we found they were separated by 112±9 average substitutions. While the four genus used in the comparison (*Chirocephalus*, *Galaziella*, *Branchinectella* and *Eubranchipus*) differed in 92±5.9 average substitutions. A phylogenetic analyses suggests monophyly for the four genus. *Chirocephalus* and *Eubranchipus* were the two closest genus (84.3 substitutions). *Galaziella* was closest to *Eubranchipus* (89.7 substitutions) and differed from *Chirocephalus* by 92.5 substitutions. Our results suggest that at least from a molecular perspective the genus *Galaziella* is as differentiated from the genus *Chirocephalus* as are the other two genus of the family examined. A closer examination of the morphology of the family Chirocephalidae is suggested to clarify the status of the different genus.

Functional diversity and trait composition of terrestrial vegetation in non-perennial rivers across hydrological and anthropogenic gradients

Maria del Mar Sánchez-Montoya[1]*, Antonio López-Pintor[1], Judit Sánchez-Nogueras[1], Zeus Freixinos[2], Luis Sierra[1], Celia Rosalía Campíñez[1], Martí Piñero-Fernández[3,4], Núria Bonada[3,4], Núria Cid[3,5], Paloma de las Heras[1]

[1]Department of Biodiversity, Ecology and Evolution, Complutense University of Madrid, 28040, Madrid, Spain. [2]Department of Ecology and Hydrology, University of Murcia, 301000, Espinardo-Murcia, Spain. [3]FEHM-Lab (Freshwater Ecology, Hydrology and Management), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Universitat de Barcelona (UB), Barcelona, Catalonia, Spain. [4]Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona (UB), Barcelona, Catalonia, Spain. [5]IRTA Marine and Continental Waters Programme, Ctra de Poble Nou Km 5.5, E43540, La Ràpita, Catalonia, Spain

msanch70@ucm.es

Drying events are key ecological drivers in non-perennial rivers, where hydrological variability and anthropogenic pressures jointly and strongly influence both aquatic and terrestrial biotic communities. While the taxonomic and, more recently, functional responses of riverine aquatic communities have been well studied, these responses remain poorly understood for terrestrial biotic communities. This is especially true for terrestrial vegetation communities inhabiting non-perennial rivers, particularly at broader spatial scales that include dry channels in addition to riparian habitats. In this study, developed within the framework of the DRY-Guadalmed Project, we investigated how taxonomic richness, functional diversity, and trait composition of terrestrial vegetation communities respond to gradients of hydrological and anthropogenic pressures in riparian and dry-channel habitats. To this end, we monitored 30 Mediterranean rivers (dry channels and co-occurring riparian habitats) previously categorized according to their level of anthropogenic pressure using both qualitative and quantitative attributes at the local scale (Mediterranean Reference Criteria), as well as according to their hydrology (hydrotypes), in the Segura and Guadiana river basins. We examined 10 traits (life form, longevity, biotype, height, leaf size, nutritional relationship, leaf phenology, woodiness, clonality, and dispersal mode) and 50 categories based on species-level identifications, and calculated taxonomic richness, functional richness, and functional evenness. RLQ and fourth-corner analyses were applied to identify broad-scale associations between species traits, taxonomy, hydrotypes, and levels of anthropogenic pressures. These findings will allow a better understanding of the ecological responses of terrestrial vegetation in non-perennial rivers to hydrological and anthropological gradients and advance the proper assessment of non-perennial rivers.

Caracterización ambiental y de las comunidades acuáticas de la balsa del Cascarro (Zaragoza, Aragón): Un trabajo colaborativo de estudiantes de máster

N. Cruces, E. López, M. Muñoz, U. de Luna, S.M. Burkard, E. Elissalt, L. Escribano, R. Libert, A. Marcos, R.M. Ramírez, I. Villegas, M.D. Visiedo, M. Antón, J. Armengol et al.

Institut Cavanilles de Biodiversitat i Biologia Evolutiva, University of Valencia Catedrático José Beltrán Martínez, 2, 46980 Paterna, Spain

nawelioso@gmail.com

En el contexto del plan de estudios del Máster en Biodiversidad: Conservación y Evolución de la Universitat de València, se evaluó de forma colaborativa y como parte de unas prácticas de campo la ecología de la balsa del Cascarro, un humedal artificial con carácter educativo situado en una zona restaurada de la ribera del Ebro, en la Reserva Natural Dirigida de los Sotos y Galachos del Ebro (Zaragoza). El bosque de ribera circundante a la laguna está gestionado periódicamente y en él dominan *Populus alba* y *Rubus ulmifolius*, pero es muy escasa la información sobre la biodiversidad acuática y el estado ecológico de la laguna, así como sobre especies invasoras de fauna. En este trabajo se estudió la limnología del Cascarro en febrero de 2026 mediante muestreo de parámetros físico-químicos, fitoplancton, zooplancton y macroinvertebrados bentónicos. Además, se exploró la fauna de vertebrados terrestres asociados al sistema. Se midió una conductividad eléctrica entre 1,9 - 2,3 mS/cm y se observaron diferencias de pH entre puntos (7,1 - 8,4), relacionadas con la diferente cobertura de caráceas. Se registraron 17 taxones en el fitoplancton, dominado por especies de pequeño tamaño, principalmente *Cryptomonas* sp. Entre los 15 taxones de zooplancton destacó *Bosmina longirostris* y entre los 11 taxones de macroinvertebrados dominaron Chironomidae y Baetidae. Se capturaron 34 *Procambarus clarkii* mediante nasas, con una longitud media del cefalotórax de 32,6 mm y una sex ratio de 1♂:1,27♀, junto a unos pocos individuos de los peces invasores *Lepomis gibbosus* y *Gambusia holbrooki*. La fauna de vertebrados terrestres asociada a los alrededores de la laguna incluyó gamo, zorro, garduña, gineta, tejón, ratón de campo, cuatro especies de quirópteros y más de 15 aves distintas. Se contribuye así al conocimiento de la biodiversidad de esta laguna y se refuerza su valor educativo.

Fire, microbes, and nitrogen: understanding post-wildfire freshwater biogeochemistry through the NITROMICS project

Beatriz García-Béjar[1], Rafael Gonzalez-Serrano[2], Dag O. Hessen[3], Rebecca A. Owens[4], Andreas Richter[5], Adrián Sánchez-Maestro[6], Nicolas Valiente[6]*

[1]Department of Analytical Chemistry and Food Technology, Faculty of Chemical Sciences and Technologies, University of Castilla-La Mancha, 13071 Ciudad Real, Spain. [2]International Center for Terrestrial Antarctic Research, University of Waikato, 3240 Hamilton, New Zealand. [3]Department of Biosciences, Centre for Biogeochemistry in the Anthropocene (CBA), University of Oslo, 0316 Oslo, Norway. [4]Department of Biology, Maynooth University, W23 F2K8 Co. Kildare, Ireland. [5]Center of Microbiology and Environmental Systems Science, Division of Terrestrial Ecosystem Research, University of Vienna, 1030 Vienna, Austria. [6]Department of Science and Agroforestry Technology and Genetics, ETSIAMB, University of Castilla -La Mancha, 02071 Albacete, Spain

nicolas.valiente@uclm.es

Wildfires are becoming more frequent and severe in Mediterranean regions due to climate change and land-use pressures. Beyond their immediate impacts on terrestrial ecosystems, fires can profoundly alter nutrient dynamics in river networks by modifying nutrient availability, erosion processes, and hydrological connectivity within catchments. Nitrogen (N) is particularly sensitive to these disturbances, as post-fire increases in nutrient availability and erosional inputs may enhance N transport from upland soils to headwater streams. These changes can influence microbial activity and N transformations in freshwater ecosystems. Microbes are the key biogeochemical drivers of the N cycle, including processes such as biological nitrogen fixation, mineralization, nitrification, and denitrification. Fire-induced shifts in microbial communities may therefore alter N turnover and the balance between N retention and N loss in stream ecosystems. However, the microbial mechanisms regulating nitrogen cycling across the terrestrial–freshwater continuum after wildfire remain poorly understood. In this context, the NITROMICS project investigates how wildfires reshape microbial nitrogen cycling in Mediterranean forest catchments by integrating biogeochemical measurements with multi-omics approaches. Specifically, NITROMICS examines (i) how wildfire affects microbial N transformation processes along the terrestrial–freshwater continuum, (ii) how fire-driven changes in soil microbiomes influence microbial communities and ecosystem functioning in streams, and (iii) how stream microbial communities respond to fire-derived microbial inocula and increased N inputs simulating post-fire runoff. To address these questions, the project combines isotope-based experiments to quantify N transformation rates with high-resolution omics approaches, including metagenomics, metatranscriptomics, and metaproteomics. By linking microbial community structure and functional activity with process measurements, NITROMICS will provide new insights into the mechanisms regulating nitrogen cycling in wildfire-affected catchments and their implications for nutrient dynamics in Mediterranean freshwater networks.

Distribution and abundance of an introduced domestic bird, Muscovy duck (*Cairina moschata*), in the Madeira Archipelago, NE Atlantic

Soledad Álvarez[1,2]*, Marie Pedaccin[3], Silvia Almeida[1,2], Patrício Ramalhosa[1,2], Aracelis Narayan[4,5], Thais Coppen[6,7,8], Giorgia Michela Ricci[1,2], Ricardo Rocha[9], Inês Órfão[1,2]

[1]MARE (Marine and Environmental Sciences Centre) / ARNET (Aquatic Research Network), ARDITI Agência Regional para o Desenvolvimento da Investigação Tecnologia e Inovação), Portugal; [2]Faculty of Life Sciences, Universidade da Madeira (Uma), Portugal; [3]Section for Freshwater Fisheries and Ecology, Technical University of Denmark (DTU), Silkeborg, Denmark; [4]Madeira Oceanic Observatory, ARDITI, Funchal, Portugal; [5]Earth Science Institute, Faculty of Science, University of Porto, Porto, Portugal; [6]Insect Collection of Madeira University (UMACI), University of Madeira, Funchal, Madeira, Portugal; [7]Center of Investigation in Biodiversity and Genetic Resources (CIBIO), University of Porto, Porto, Portugal; [8]Department of Biology, Faculty of Science of Porto University (FCUP), Porto, Portugal; [9]Department of Biology, University of Oxford, UK

soledad.alvarez@mare.arditi.pt

The Muscovy duck (*Cairina moschata*) is a highly adaptable waterfowl species native to Central and South America. Its pronounced behavioural plasticity and opportunistic feeding strategy enable year-round reproduction under favourable environmental conditions. The domesticated species is closely associated with aquatic habitats and anthropogenically modified landscapes and has been widely intentionally and accidentally introduced across multiple regions worldwide. Introduced populations of Muscovy ducks may exert a range of ecological impacts, including degradation of water quality, competition and hybridisation with native species, predation, and disease transmission. These concerns are especially relevant on oceanic islands, which are disproportionately vulnerable to biodiversity loss due to biological invasions. In this context, the Madeira Archipelago, located within the Macaronesian region, has documented records of the Muscovy duck dating back to at least 1995. Current evidence regarding its presence and abundance suggests that the species is now well established in the archipelago. This study evaluates the occurrence and abundance of the Muscovy duck across the Madeira Archipelago in relation to patterns of human population density. We integrated historical records from citizen science platforms, a review of the peer-reviewed literature, and targeted field surveys. In addition, this work explores the potential relationships between physicochemical characteristics of surface waters in the island's streams and the spatial distribution of the species. By combining multi-year biological records with environmental and spatial data, this study aims to improve understanding of the species' adaptation to insular freshwater systems, assess its potential ecological and public health implications, and propose preventive and management strategies to minimise the risks associated with its expansion within this environmentally sensitive island ecosystem.

Advancing flood resilience in Mediterranean regions through integrated governance and nature-based solutions

Meritxell Abril[1]*, Lorenzo Proia[1], Enol Nieto[1], Juan Miguel Rosillo-Comino[2], Celso García[2], Pablo Rodríguez-Lozano[2], Christos Makris[3], Yannis Androulidakis[3], Stefania Santoro[4], Angelos Kokkinos[3], Zisis Mallios[3], Theofanis Karambas[3], Raffaele Giordano[4], Virginia Rosa Coletta[4], Valeri Penchev[5], Shirin Shukrieva[5], Manuel Sapiano [6], Aaron Cutajar[6], Marzio Melis[6], Marco Graziani[6], Angela Ingenio[6], Xavier Llort[7], Jordi Roca[7], Joan Lloret[8], Elena Barrufet-Bravo[8], Maria Soria[1]

[1]BETA Technological Centre (UVic-UCC), Vic, Spain. [2]GLOWATER Research Group, Universitat de les Illes Balears, Palma de Mallorca, Spain. [3]Aristotle University of Thessaloniki, Thessaloniki, Greece. [4]Water Research Institute – National Research Council, Bari, Italy. [5]Black Sea – Danube Association for Research and Development, Varna, Bulgaria. [6]Energy and Water Agency, Qormi, Malta. [7]Hydrometeorological Innovative Solutions, Barcelona, Spain. [8]Euroregion Pyrenees Mediterranean, Perpignan, France

meritxell.abril@uvic.cat

Across the Mediterranean, while natural flooding processes are ecologically essential, flash floods are becoming more frequent, more intense, and more damaging. Managing these accelerating risks requires more than technical measures alone—it demands coordination, shared understanding, and a truly integrated approach among all actors involved. This is precisely what the LocAll4Flood initiative set out to strengthen across Spain, Malta, Italy, Greece, and Bulgaria. In recent months, we have organized a series of training programs and co-creation workshops in several high-risk flood areas. These activities brought together a broad spectrum of participants: local and regional authorities (e.g. civil protection services, environmental departments), representatives from civil society, the private sector, and academia. One of the core elements of the project was a dedicated process to identify the most suitable Nature-Based Solutions for specific Mediterranean flood-prone sites, resulting in a comprehensive catalogue. These options were grounded in prior technical assessments, ensuring that proposed measures were not only scientifically robust but also adapted to local realities. Among them, restoration actions emerged as particularly effective tools to mitigate flood risks. Stakeholders collaboratively assessed the barriers, co-benefits, and trade-offs associated with the nature-based solutions included in the catalogue. These exchanges proved essential, highlighting not only the technical feasibility of the measures, but also the administrative requirements, financial constraints, and social factors that influence their successful implementation. What emerged is unequivocal: measures such as river restoration, are powerful tools for reducing flood risk. However, their effectiveness depends on broad stakeholder acceptance and strong cross-institutional coordination. Ultimately, strengthening flood resilience in the Mediterranean also requires evolving water governance systems—shifting toward more collaborative, transparent, and adaptive models capable of responding to the complex challenges posed by a changing climate.

Environmental reuse of reclaimed wastewater in Nature-Based Solutions to enhance hydrological and ecological resilience in L'Albufera (Valencia)

Ainhoa Gaudes[1]*, Alba Catalan[1], Inés Sanchis[1], Pablo Sanchez-Cueto[1], Ángela Baeza[2], Núria Oliver[2], Javier Jiménez-Romo[2]

[1]Leitat Technological Center, 08225 Terrasa (Barcelona), Spain. [2]Global Omnium Medioambiente, 46014 Valencia, Spain

agaudes@leitat.org

L'Albufera de Valencia, a Mediterranean RAMSAR wetland, currently faces persistent hypereutrophication and significant hydrological stress due to declining water inputs, diffuse pollution, and altered flooding regimes. As part of the WATERGRID1 project, the Valencia peri-urban site focuses on strengthening the ecological and hydrological functioning of the Turia–Albufera system through large-scale Nature-Based Solutions (NBS), with particular emphasis on the role of constructed wetlands and the managed flooding capacity of traditional rice fields. At the core of this peri-urban water-grid lies the Tancat de Milia, a 33.4-ha constructed wetland built upon former rice paddies. The system treats the tertiary effluent of the Albufera Sur WWTP before environmental reuse, receiving approximately 2, 904 m^3/day—around 11% of the plant's secondary effluent—and enabling the delivery of ~1.06 hm^3/year of high-quality water to the lagoon. Historical monitoring shows that the wetland enhances water quality substantially, achieving reductions of 41% in total phosphorus, 59% in total nitrogen, and 56% in suspended solids when treating lake water. When treating tertiary effluent, nutrient removal remains effective (27% TP, 44% TN), with final TP values (≈0.12 mg P/L) matching ecological requirements for inflow water to the lagoon. The wetland also supports high biodiversity, providing habitat for endangered species such as *Botaurus stellaris*, *Locustella luscinioides*, *Emys orbicularis*, and *Valencia hispanica*. Within the broader WATERGRID vision, the Tancat de Milia will be complemented by perennial flooding of some rice fields with reclaimed water, which act as a dynamic water-retention and distribution system to the lagoon. Water and soil quality will be monitored in these fields, along with other ecosystem services, such as buffering stormwater peak flows, regulating seawater intrusion into groundwater, and enhancing biodiversity through habitat creation. Together, the Tancat de Milia and the rice-field flooding system form a peri-urban NBS network that improves water quality, stabilizes hydrological cycles, improves ecological flow patterns, enhances resilience to droughts and floods of L'Albufera ecosystem.

The role of remote sensing in the context of Nature-based Solutions (NbS): systematic review of the literature focused on sustainable urban drainage

Gabriela B. Silveira, Lucia H. R. Rodrigues*, Rodrigo C. D. de Paiva, Anderson Ruhoff

Hydraulic Research Institute, Federal University of Rio Grande do Sul, Porto Alegre, Brasil

luciarrodrigues@gmail.com

This study investigated the role of Remote Sensing (RS) in the context of Nature-based Solutions (NbS) applied to urban drainage, through a systematic review and bibliometric analysis. The paper addresses climate adaptation and strengthening urban water resilience by examining how RS technologies have supported the design, planning, and evaluation of NbS in the face of increasing extreme hydrometeorological events. The research was conducted based on a structured search in the Scopus and Web of Science databases, identifying 18 studies published between 2020 and 2025, selected according to predefined keyword-based criteria. The analysis revealed recent growth in publications, a strong concentration of case studies, and a predominance of productions from countries in the Global North. The scientific mapping indicated the centrality of concepts such as urbanization, climate change, hydrology, and resilience. The literature review highlighted the recurrent use of optical and radar sensors — especially Sentinel and Landsat — to derive environmental variables integrated with geoprocessing and hydrological modelling tools. The studies converge on objectives such as identifying priority areas for NbS, assessing effectiveness in flood reduction, and developing integrated methodologies. In this context, NbS are understood as interventions that act on urban eco-hydrological processes, bringing drainage management closer to a systemic view of water in the territory. The results highlight RS as an important instrument of technological innovation in the planning, monitoring, and evaluation of NbS. Therefore, the integration between NbS and RS constitutes a strategic approach to innovation in urban water management, directly contributing to the strengthening of water resilience in the face of climate change.

Combining eDNA and hydroacoustic approaches to assess fish populations in a Mediterranean reservoir

Carmen Duque-Amado[1]*, Alberto Criado[1], Omar Monteoliva[1], Susana Deus[1], María Fernández[1], Concha Durán[2], Silvia Perea[3], Ignacio Doadrio[3], Agustin Monteoliva[1]

[1]Ecohydros S.L., Maliaño, Spain. [2]Confederación Hidrográfica del Júcar (CHJ), Valencia, España. [3]Museo Nacional de Ciencas Naturables, Madrid, España

cduque@ecohydros.com

Accurate estimation of fish community composition and biomass is essential for effective management of freshwater ecosystems. Hydroacoustic surveys provide robust estimates of total fish density and biomass, but their capacity to resolve species-level composition remains limited. Environmental DNA (eDNA) techniques offer a promising, non-invasive alternative to complement acoustic data and improve species-specific assessments. This study explores the integration of quantitative PCR (qPCR), high-throughput sequencing, and hydroacoustic surveys to evaluate common carp (*Cyprinus carpio*) populations in a Mediterranean reservoir. The research is part of a doctoral thesis aiming to assess whether eDNA can support the partitioning of global fish biomass estimates into more accurate species-level proportions compared to traditional capture-based methods. Three eDNA sampling campaigns targeting common carp were conducted over a two-year period. These surveys were combined with hydroacoustic assessments of fish density and biomass. Between sampling campaigns, intensive management actions resulted in the removal of several tonnes of carp, providing an independent reference for evaluating population changes. High-throughput sequencing was used to characterize the broader fish community and contextualize qPCR-based abundance patterns. Preliminary results indicate consistent relationships between carp-specific eDNA concentrations, acoustic biomass estimates, and documented biomass removal. Temporal trends suggest that qPCR signals respond to major reductions in carp abundance, while metabarcoding data provide complementary information on community restructuring following management interventions. Our findings support the potential of combining eDNA and hydroacoustic approaches as a cost-effective and minimally invasive framework for monitoring fish populations. This integrated methodology enhances species-level resolution and improves the interpretation of acoustic data, contributing to more informed management and restoration strategies in regulated freshwater systems.

Decadal limnological trends and evidence of trophic status in the Alto Rabagão and Aguieira reservoirs (2014–2024)

Geissielen Andrade Lauriuchi[1,2], Catarina Guimarães[2]*, Sara C. Antunes[2,3]

[1]Institute of Science and Technology of Sorocaba, São Paulo State University "Júlio de Mesquita Filho", Sorocaba, Brazil. [2]Department of Biology, Faculty of Sciences, University of Porto, Porto, Portugal. [3]Interdisciplinary Centre for Marine and Environmental Research, Porto, Portugal

Catarinaguimaraes@live.com.pt

Climate change and population growth intensifying anthropogenic pressures on freshwater ecosystems, altering nutrient dynamics, optical properties, and overall ecosystem functioning. Land-use patterns within river basins, particularly agriculture and forestry, further increase diffuse nutrient and sediment inputs, heightening the risk of eutrophication in lentic systems. Long-term limnological analyses are therefore crucial to detect gradual trophic shifts and informing evidence-based management under the Water Framework Directive (WFD). This study assessed decadal (2014–2024) variability in water quality in the Alto Rabagão and Aguieira reservoirs (Portugal), integrating in situ monitoring data with official records from the Agência Portuguesa do Ambiente (APA/SNIRH). across three WFD management cycles, Alto Rabagão consistently retained “Good” ecological status, whereas Aguieira fluctuated between “Moderate” and “Poor”. Chlorophyll-a (Chl-a), Secchi depth, and turbidity were analysed using descriptive statistics, ordinary least squares (OLS) regression, and the non-parametric Mann–Kendall test ($\alpha = 0.05$). In Alto Rabagão, Chl-a increased significantly ($\tau = 0.202$; $p = 0.001$), accompanied by decreasing transparency ($\tau = -0.327$; $p < 0.001$) and rising turbidity ($\tau = 0.210$; $p = 0.011$). Together, these trends indicate enhanced phytoplankton biomass and progressive optical degradation, suggesting emerging trophic pressure despite the stable “Good” ecological classification. In contrast, Aguieira exhibited no significant trends in Chl-a or transparency, indicating trophic stability over the decade. However, turbidity decreased significantly ($\tau = -0.264$; $p < 0.001$), reflecting improved physical water column conditions without a corresponding improvement in ecological status. Overall, the two reservoirs displayed contrasting limnological trajectories. Monotonic trend analyses proved effective for detecting subtle ecosystem changes that may not be reflected in aggregated WFD classifications. Moreover, the temporal consistency of Chl-a, turbidity, and transparency supports their integration with satellite-derived products, enabling calibration, validation, and the future development of predictive models for reservoir water quality. Acknowledgements: Project "2Qua - Water Quality and Quantity, the challenge for the present and future" (ref. 2023.17517.ICDT) is supported by national funds, through the Foundation for Science and Technology (FCT, Portugal), and European funds, through COMPETE2030 (COMPETE2030-FEDER-0691700). https://doi.org/10.54499/2023.17517.ICDT

Cyanobacteria and their impacts on water quality in cascading reservoirs on the Tietê River (São Paulo, Brazil)

Vinicius de Leles Almagro[1], Maria Dolores Sendra[3], Xavier Sòria-Perpinyà[4], Eduardo Vicente[3], Marcelo Pompêo[1, 2], Viviane Moschini-Carlos[1]*

[1]Institute of Science and Technology of Sorocaba, Av. Três de Março, 511 – Alto da Boa Vista, São Paulo State University, Unesp, SP, Brazil. [2]Depto. de Ecologia, USP, Rua do Matão, 321 – Butantã, São Paulo, Brazil. [3]Cavanilles Institute of Biodiversity and Evolutionary Biology (ICBiBE), University of Valencia, 46010, Valencia, Spain. [4]Image Processing Laboratory (IPL), University of València, Spain

viviane.moschini@unesp.br

We aimed to investigate the phytoplankton community of three sequential cascading reservoirs (Promissão – Pr, Nova Avanhandava – NA and Três Irmãos – TI) from the Middle/Low Tietê River basin, one of the most polluted rivers on the state of SP, Brazil, through traditional and molecular methods. During May and October 2024, integrated water samples were taken from the riverine, center and dam zones of each reservoir. Troll 500 and TurnerC3 probes took measurements for limnological variables and Phycocyanin (Phy), respectively. Chlorophyll-a (Chla) and total phosphorus – TP; total nitrogen – TN were analyzed through laboratory assays and cell density and biovolume were estimated through the Utermöhl method. DNA extraction was performed through QIAGEN DNEasy Plant Mini kits, followed by amplification, sequencing and taxonomic determination. Our results showed the formation of an eutrophication gradient between the reservoirs, where NA and Pr were closely related during both months, presenting higher concentrations of nutrients (TP: 17.2 – 153.2 µg/L; TN: 106.5 – 612.4 µg/L) and Chla (7.4 – 128 µg/L). TI showed lower values than its peers (TP: 5.3 – 21.2 µg/L; TN: 77.7 – 232.3 µg/L; Chla: 3.7 – 12.4 µg/L). The reservoirs showed high biomasses of Cyanobacteria, especially *Microcystis* sp., with the exception of TI, where *Raphidiopsis* sp. dominated the river and center zones. Despite this, most species were co-occuring in all reservoirs, albeit in different biomasses. These results were corroborated by the 16S rDNA sequencing, where *Microcystis* PCC-7914 represented most of the relative frequency of the Cyanobacteria detected genetic material, followed by *Pseudanabaena* sp. PCC-7429 and *R. raciborskii* CRJ1. Our findings point to a worrying situation in these three bodies of water, given that the occurrence of cyanobacteria was both recurrent and stable throughout the year. Support: FAPESP (2024/17098-8), CNPq (303731/2025-7)

Spatiotemporal analysis of chlorophyll-a concentration in the Barra Bonita Reservoir (Brazil) Using Sentinel-2 Satellite Imagery

Geissielen Lauriuchi[1], Rafaella Menezes[1], Bianca Silva[1], Gabriel Caballero[3], Xavier Sòria-Perpinyà[3], Jesus Delegido[3], Viviane Moschini-Carlos[1], Eduardo Vicente[4], Marcelo Pompêo[2]*

1University of São Paulo State (UNESP), ICT, Sorocaba Campus, SP, Brazil. [2]Department of Ecology, São Paulo University, São Paulo, SP, Brazil. [3]Image Processing Laboratory, Valencia University, Paterna, Spain. [4]Department of Microbiology and Ecology, Valencia University, Burjasot, Spain

mpompeo@ib.usp.br

This study evaluated the water quality of the Barra Bonita Reservoir, localized in São Paulo State (Brazil), focusing on the Piracicaba (PIR) and Tietê (TIE) river branches, by estimating chlorophyll-a (Chl-a) with Sentinel-2 imagery. The reservoir is polymictic, with water retention times varying seasonally from approximately 30 days in summer to up to six months in winter. Its maximum average width is 5.8 km, with an average depth of 35 m, and a hydroelectric generation capacity of up to 140.76 MW. The arms studied are each over 30 km long. The Case2extreme (C2X) neural network, trained with atmospherically corrected reflectance and in situ data, was applied to images Sentinel 2. The optimized model generated a Chl-a time series (2016–2024), enabling spatial–temporal analysis. Mean Chl-a concentrations were 18.9 ± 11.8 $\mu g \cdot L^{-1}$ (PIR) and 33.6 ± 14.2 $\mu g \cdot L^{-1}$ (TIE), classifying them as eutrophic and supereutrophic, respectively, according to the Trophic State Index. Statistical modeling showed a significant increasing trend in PIR, with a mean monthly rise of 1.223 $\mu g \cdot L^{-1}$. In TIE, although the trend was not statistically significant, a visual upward pattern was noted, suggesting convergence with PIR levels in about one year. Seasonal dynamics were mainly influenced by maximum temperature, while precipitation contributed to nutrient runoff and eutrophication. These results reinforce the need for integrated management to mitigate algal blooms and safeguard water quality, especially when data suggest that diffuse sources are the main contributors of nutrients, particularly to the Piracicaba River arm. Grants: Fapesp 2021/10637-2 and 2023/13367-1; CNPq 302224/2022-0

Ostracoda from ricefields in the Eastern Iberian Peninsula: dominance of non-native species and distance-decay of similarity

Francesc Mesquita-Joanes*, Bruno Chianese, Andreu Castillo-Escrivà, Alexandre Mestre, Maria Anton-Pardo

Institut Cavanilles de Biodiversitat i Biologia Evolutiva, University of Valencia Catedrático José Beltrán Martínez, 2, 46980 Paterna, Spain

mezquita@uv.es

Ricefields in temperate areas constitute novel aquatic ecosystems, as they are temporary habitats filled in summer, unlike most non-regulated temporary ponds and lakes. This anomaly has been suggested to facilitate the incorporation of non-native species to ricefields, particularly those of tropical origin dwelling in warm temporary waters. But the distribution of organisms in a homogeneous environment such as ricefields can be heterogeneous, mostly due to uneven dispersal effects and ecological drift. In this work we explore the distribution of Ostracoda collected in summer 2025 from ricefields in the Ebro Delta and Albufera of Valencia Natural Parks, with a multiscale spatial approach; in each of these two areas located 180 km apart, we sampled two subareas 10 km apart, and in each of these subareas we studied five ricefields 100 m apart, accounting for 20 samples in total. Thirteen ostracod species were found, out of which three were cosmopolitan, and 10 were non-native invasive species. The most common species were *Vizcainocypria viator*, *Cypridopsis vidua* and *Fabaeformiscandona subacuta*. Species composition was significantly different between the two most distant areas but not between subareas within each area. A distance-decay of similarity was observed, with a slope of -0.039 between the Jaccard index and the log of distance (in km) between sites. Non-native ostracod species therefore distributed heterogeneously in the rice areas of the invaded region, probably due to differences in colonization history, together with priority and environmental effects and ecological drift.

Emergencia de Grandes Branquiópodos en lagunas con diferente frecuencia de inundación

Ismael Díaz-Reina*, Carmen Díaz-Paniagua, Carlos Vázquez-Chanivet, José María Gordillo, José Luis Sierra, Rocío Fernández-Zamudio, Vanesa Céspedes, Isabel García, Margarita Florencio

Estación Biológica de Doñana, CSIC, Avenida Américo Vespucio 26, Sevilla 41092, Spain

ismael.diaz.reina@ebd.csic.es

Los grandes branquiópodos son habitantes casi exclusivos de lagunas temporales, donde depositan quistes de resistencia que pueden permanecer viables largos periodos hasta la siguiente inundación. Para este estudio, se recogió sedimento de 8 lagunas temporales de Doñana donde se habían detectado anteriormente grandes branquiópodos. Se prepararon 5 acuarios con sedimento de cada laguna, y fueron inundados durante 44 días en cámaras climáticas a 14 °C, con un ciclo diario luz/oscuridad de 11/13 horas. Los anostráceos y notostráceos fueron identificados y extraídos, antes de que pudieran depositar huevos. Se detectaron 3 especies de Anostráceos, 1 Notostráceo y 1 Spinicaudata. *Branchipus cortesi* y *Triops baeticus* aparecieron en el 87.5% de las lagunas, *Tanymastix stagnalis* y *Maghrebestheria maroccana* en el 62.5%, mientras que *Chirocephalus diaphanus* solo se detectó en el 25%. Entre los anostráceos, la primera especie detectada fue *T. stagnalis*, que emergió a partir de un periodo medio de (8.8) 8-9 días de inundación, y apareciendo como la especie de anostráceo más abundante en una laguna efímera. La especie *Branchipus cortesi* fue la más abundante en la mayoría de las lagunas, pero más tardía que *T. stagnalis*, emergiendo a partir de 17.9 (9-28) días, mientras que *C. diaphanus* fue la más tardía y muy escasa, emergiendo a partir de 28 días. *Triops baeticus* y *M. maroccana* fueron también abundantes en las lagunas con menor frecuencia de inundación, detectandose *T. baeticus* a partir del día 15 y *M. maroccana* a partir del día 21. En general, se aprecia mayor abundancia de individuos y riqueza específica en lagunas que han permanecido secas un mayor número de años (menor frecuencia de inundación) frente a las de inundación anual, lo que revela la gran resiliencia de estas especies frente a condiciones de sequía.

Local wind-mediated dispersal of zooplankton in a Mediterranean pond: a quantitative assessment

Cristina Arenas-Sánchez*, Raquel Ortells, María José Carmona, Manuel Serra, Javier Montero-Pau, Eduardo M. García-Roger

Institut Cavanilles de Biodiversitat i Biologia Evolutiva, Universitat de València, c/ Catedrático José Beltrán, 2. 46980 Paterna (València), España

cristina.as.20@gmail.com

Dispersal shapes species distributions, population dynamics, and community structure. While small organisms are assumed to exhibit high dispersal, quantitative data remains scarce, particularly for zooplankton. For these organisms, wind is a recognized vector at local scales, but its role in short-distance propagule transport is poorly quantified. In this study, we conducted a 15-month field experiment in a temporary pond to systematically quantify wind dispersal of zooplankton propagules. We investigated how wind regime and pond characteristics influence dispersal patterns in two major zooplankton groups, ─copepods and rotifers─ which differ markedly in propagule size. We also analysed the relationship between propagule size and dispersal distance. Our findings reveal significant temporal variability in wind dispersal and distinct dispersal patterns between the two groups. Wind conditions and pond characteristics strongly influenced propagule aerial transport. While rotifer dispersal decreased with distance, copepods exhibited the opposite trend, suggesting propagule size as a key factor in dispersal efficiency. Wind dispersal proved highly variable, depending on fluctuating wind conditions, pond volume and propagule availability. This study offers one of the first long-term, field-based quantifications of wind zooplankton dispersal and underscores the ecological relevance of wind as a local-scale dispersal vector, even during the wet phase of temporary ponds.

Environmental gradients drive the beta diversity of benthic macroinvertebrate communities in tropical estuaries

Carlinda Raílly Medeiros[1]*, Maria Eduarda Santana Veríssimo[2], Daniele Jovem-Azevêdo[2,3,4], Luiz Ubiratan Hepp[5], Raphael Ligeiro[6], Joseline Molozzi[2]

[1]Instituto Federal do Sertão Pernambucano, Floresta, Pernambuco, Brazil. [2]Programa de Pós-graduação em Ecologia e Conservação, Universidade Estadual da Paraíba, Paraíba, Brazil. [3]Instituto Federal da Paraíba, Princesa Isabel, Paraíba, Brazil. [4]Programa de Pós-Graduação em Ciências Naturais e Biotecnologia, Universidade Federal de Campina Grande, Paraíba, Brazil. [5]Programa de Pós-Graduação em Biologia Animal, Universidade Federal do Mato Grosso do Sul, Três Lagoas, Mato Grosso do Sul, Brazil. [6]Programa de Pós-graduação em Ecologia, Universidade Federal do Pará, Belém, Pará, Brazil.

carlindarailly@gmail.com

Benthic macroinvertebrate communities vary across space and time because of the hydrological and environmental dynamics of estuaries. These processes regulate estuarine environmental conditions, ecosystem function, and shifts in the beta diversity of biological communities. Here, we (i) assessed the beta diversity of benthic macroinvertebrate communities between hydrological periods and along an estuarine gradient, and (ii) tested the influence of environmental variables and sediment composition on this diversity. This study was conducted in two tropical estuaries with different anthropogenic impact levels during the dry and rainy periods. Four zones were defined in each estuary, spanning the entire estuarine gradient, with three sampling sites and three sampling units per site. Subtidal benthic macroinvertebrates were collected from each zone. Physical and chemical variables of the water and sediment granulometric composition were measured. Ordination analyses were used to quantify beta diversity. Environmental gradients influenced community composition more strongly than sediment characteristics and instability caused by freshwater inflow. Beta diversity was lower during hydrological periods with reduced dissolved nutrient concentrations. In general, intermediate zones along the gradient showed higher beta diversity, demonstrating greater environmental variability. Our results demonstrate that nutrient concentrations structure estuarine benthic macroinvertebrate communities: periods with better water quality show lower community variability, whereas areas with stronger freshwater– saltwater mixing exhibit increased variability, highlighting the role of environmental heterogeneity in sustaining biodiversity. Maintaining balanced estuarine gradients and environmental quality is fundamental to supporting diverse and stable benthic communities that underpin the functioning and resilience of coastal ecosystems.

Diversidad y bioindicación de macroinvertebrados acuáticos: caso de estudio neotropical

Rossember Saldaña-Escorcia[1]*, Cristian Elian Castañeda-Sanguino[2], Víctor Andrés Salas-Ospino[2]

[1]Grupo de Investigación en Estudios Sanitarios y Ambientales, Ingeniería Ambiental y Sanitaria, Departamento de Ciencias Ambientales y Sanitarias, Universidad Popular del Cesar, Aguachica, Carrera 40 # 1 Norte-58, Aguachica 25010, Colombia. [2]Semillero de Investigación en Ambiente, Economía y Desarrollo Social (ESODE), Grupo de Investigación en Gestión Ambiental y Territorios Sostenibles, Ingeniería Ambiental y Sanitaria, Departamento de Ciencias Ambientales y Sanitarias, Universidad Popular del Cesar, Aguachica, Carrera 40 # 1 Norte-58, Aguachica 25010, Colombia

rsaldanae@unicesar.edu.co

El arroyo El Gallinazo representa una fuente hídrica clave para el municipio de Aguachica en el departamento del Cesar, tanto por su valor ecológico como por su importancia en el abastecimiento local. En este contexto, el objetivo de este estudio fue determinar la calidad de agua de un tramo del arroyo El Gallinazo mediante la diversidad de macroinvertebrados acuáticos bioindicadores. El estudio se realizó en tres puntos del arroyo, en los cuales se midieron algunos parámetros físicos y químicos, como: conductividad, turbiedad, temperatura, oxígeno disuelto, pH, solidos suspendidos totales, DQO, DBO, nitratos y fosfatos. Para evaluar la diversidad de macroinvertebrados se tuvieron en cuenta los índices diversidad de Simpson, Margalef, Shannon-Weaver y Pielou, además del índice biótico BMWP/COL. Como resultado, se recolectaron 601 individuos de macroinvertebrados, pertenecientes a 41 familias y 18 órdenes. El análisis de los índices de diversidad reveló fluctuaciones entre los sitios evaluados y muestreos realizados. La estación 1 mostró mayor riqueza en el segundo muestreo, pero menor equitatividad; la estación 3 mantuvo alta diversidad; mientras que la estación 2 experimentó una disminución en diversidad, reflejando una dominancia de especies y menor equidad en el segundo muestreo. Estos datos nos indican que la calidad del agua en el tramo estudiado del arroyo El Gallinazo varía entre ligeramente contaminada y muy limpia. Se enfatiza la relevancia de realizar monitoreos periódicos y se recomienda mantener un seguimiento constante del arroyo como contribución a la gestión integral de los recursos hídricos.

Wind-driven sediment resuspension and internal nutrient loading in a shallow hypertrophic lagoon: Preliminary results

Noelia Campillo-Tamarit[1]*, Juan Víctor Molner[1], Manuel Muñoz-Colmenares[1], Miguel Jover[2], Juan Miguel Soria[1]

[1]Cavanilles Institute of Biodiversity and Evolutionary Biology (ICBiBE), University of Valencia, Catedràtic José Beltrán Martínez, 2, 46980 Valencia, Spain. [2]Aquaculture and Biodiversity Research Group, Institute of Animal Science and Technology, Universitat Politècnica de Valencia, Camino de Vera 14, 46022 Valencia, Spain

noelia.campillo@uv.es

The Albufera of Valencia is a shallow (< 1.5 m), hypertrophic coastal lagoon where wind serves as the primary driver for vertical mixing and sediment-water interaction. This study, currently in progress, investigates how wind-induced resuspension triggers the release of nutrients and organic matter from the sediment into the water column, a process known as internal refertilization. Systematic sampling was conducted at the lagoon's quay, collecting paired samples from the surface and near bottom (1.20 m) to evaluate the system's homogeneity under varying wind conditions from 5 to 40 km/h. The analytical framework includes an exhaustive characterization of Total Suspended Solids, Total Phosphorus (TP), pigments (Chlorophyll-a and carotenoids), and various carbon fractions: Total Organic Carbon, Dissolved Organic Carbon, Total Inorganic Carbon, and Dissolved Inorganic Carbon. Preliminary results confirm the lagoon's polymictic nature, as no significant differences were detected between surface and bottom samples. Data indicates a direct correlation between wind intensity and increases in turbidity and TSS. Furthermore, initial findings show that resuspension events significantly elevate the concentrations of TP. This physical forcing is followed by a temporal lag before a biological response in Chlorophyll-a is observed. These early results underscore the critical role of wind in regulating internal loading, a key factor for the management and restoration of the lagoon in the context of climate change.

Taxonomic and functional beta diversity of macroinvertebrates in the semiarid region: the changes mediated by drought and rainy periods

Betsy Dantas de Medeiros[1], Carlinda Railly Medeiros[2], Maria Eduarda Santana Veríssimo[1], Evaldo de Lira Azevêdo[1,3], Joseline Molozzi[1], Maria João Feio[4], Daniele Jovem-Azevedo[1,3,5]*

[1]State University of Paraíba, Postgraduate Program in Ecology and Conservation, Campus I, Campina Grande - Paraíba, Brazil. [2]Federal Institute of Sertão Pernambucano – IFSertãoPE, Campus Floresta, Floresta - Pernambuco, Brazil. [3]Federal Institute of Paraíba – IFPB, Campus Princesa Isabel - Paraíba, Brazil. [4]University of Coimbra, MARE - Marine and Environmental Sciences Centre, Department of Life Sciences, Coimbra, Portugal. [5]Federal University of Campina Grande, Postgraduate Program Natural Sciences and Biotecnology, Campus Cuité - Paraíba, Brazil.

daniele.jazevedo@gmail.com

In semiarid regions, hydrological and climatic pressures impose strong environmental filters on aquatic communities. There is still limited knowledge about how taxonomic and functional dimensions of biodiversity respond to seasonal hydrological fluctuations and how the environmental filters differences in shaping community structure. Addressing this gap is essential for understanding the resilience and functioning of freshwater ecosystems in water-limited landscapes. This study analyzed the taxonomic and functional structure of Chironomidae (Diptera) assemblages in three ecoregions under a semiarid climate, Northeast Sertaneja Depression, Central Plain of the Borborema Plateau, and South Sertaneja Depression, during contrasting hydrological periods (dry and rainy seasons). Environmental variables (physical and chemical parameters, habitat and landscape), taxonomic composition, and functional traits were used to assess beta diversity patterns and the contribution of each sampling site for beta diversity (LCBD). Environmental conditions differ significantly between ecoregions and between hydrological periods, with nutrient enrichment and organic matter influencing assemblages' composition. A total of 11,794 individuals from 28 genera were recorded, with *Goeldchironomus*, *Polypedilum*, *Tanytarsus*, and *Aedokritus* predominating. Both taxonomic and functional β- diversity varied significantly between hydrological periods, but not between ecoregions ($p<0,05$). Redundancy analysis (RDA) indicated that taxonomic structure was primarily shaped by nutrient and organic matter enrichment during the dry season, while functional structure was more influenced by hydrological conditions during the rainy season. These results suggest that temporal (seasonal) dynamics and local environmental factors (environmental filters) act as stronger modulators of community structure than spatial (ecoregional) differences. Despite taxonomic change, high functional redundancy indicates the maintenance of ecological functions under environmental fluctuations. This study emphasizes the importance of integrating taxonomic and functional approaches in the management of semiarid freshwater ecosystems to improve conservation planning and promote resilience under different hydrological regimes.

Chronic impact of glufosinate and glyphosate on marine microalgae: photosynthetic alterations and oxidative stress in *Tetraselmis* sp.

Alondra A. Cortés-Téllez[1]*, Ana D'ors de Blas[2], Sebastián Sánchez-Fortún Rodríguez[2], Joel E. López Meza[3], Ramón Cervantes Rivera[3], Mª Carmen Bartolomé-Camacho[1]

[1]Environmental Toxicology Laboratory, Faculty of Chemistry-Pharmacobiology, Universidad Michoacana de San Nicolás de Hidalgo (UMSNH), Morelia, Mexico. [2]Dept. of Pharmacology and Toxicology, Faculty of Veterinary, Universidad Complutense de Madrid (UCM), Madrid, Spain. [3]Multidisciplinary Center for Biotechnology Studies, Faculty of Veterinary, Universidad Michoacana de San Nicolás de Hidalgo (UMSNH), Morelia, Mexico

alondra.cortes@umich.mx

The use of broad-spectrum herbicides such as glufosinate-ammonium and glyphosate has been essential for maintaining agricultural productivity in Mexico, especially in high-value crops like corn and avocado. However, their intensive application has raised concerns about chronic adverse responses in non-target aquatic organisms, particularly microalgae, which form the base of food webs and play a fundamental role in the primary productivity of aquatic ecosystems. Therefore, exposure to these herbicides results in alterations in key metabolic pathways for life, such as photosynthesis. In this context, the aim of this research was to evaluate alterations in photosynthetic activity and the generation of reactive oxygen species (ROS) in the microalga *Tetraselmis* sp. exposed long-term to low concentrations of glufosinate-ammonium and glyphosate. The treatments were applied at concentrations below the NOEC of 0.0001 mg L^{-1} for glufosinate (GLA) and 0.0005 mg L^{-1} for glyphosate (GLY) in chronic exposures at 3, 7, 14, 21, and 28 days on *Tetraselmis* sp. for photosynthesis assessment (Pg = R + Pn) and at 28 days for reactive oxygen species (ROS) estimation through DCFH fluorescence by fluorimetry. The results show that in the short term (3–7 days), GLA moderately reduces total photosynthetic productivity (Pg, 19.69 ± 3.45%), while GLY initially affects respiration (R, 32.56 ± 6.44%). From 14 to 28 days, both herbicides completely inhibit net CO_2 fixation (Pn). Furthermore, they stimulated ROS generation between 40.09 ± 0.59% for GLY and 43.74 ± 0.57% for GLA. Finally, this suggests that GLA, as an alternative to GLY, also produces total uncoupling of photosynthesis with high production of oxidative stress in *Tetraselmis* sp., as a member of the phytoplankton community, plays a key role in primary production, so the observed alterations imply serious ecological consequences.

Assessing the effects of chemical mixtures on high levels of biological organization: an experimental and a modelling approach

Diego Ferreira Gomes[1,2]*, Carlos Pascual March[1], Evaldo Luiz Gaeta Espíndola[2], Andreu Rico[1]

[1]Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, C/ Catedrático José, Beltrán 2, 46980, Paterna, Valencia, Spain. [2]Laboratory of Ecotoxicology and Applied Ecology - LEEA, Department of Hydraulics and Sanitation, São Carlos School of Engineering, University of São Paulo, São Carlos, SP, Brazil

diego.frgomes@usp.br

Chemical pollution is a global threat to aquatic biodiversity. Retrospective chemical risk assessments are based on aquatic toxicity data for single-test species, and thus lack a comprehensive assessment of chemical impacts on high levels of biological organization (i.e., populations, communities). Although micro/mesocosm studies provide a relevant tool to assess chemical effects on populations and communities (for individual chemicals and mixtures), their use for retrospective risk assessments remains limited. This project aims to advance our understanding of the impacts of contaminant mixtures in aquatic ecosystems by utilizing knowledge generated from new and existing micro- and mesocosm experiments, and by testing the accuracy of the PERPEST model (an AI-based model fed with micro and mesocosm data) to make accurate predictions regarding contaminant mixture effects. A mesocosm experiment will be conducted in 1 m^3 mesocosms (located in the Albufera Natural Park, Valencia, Spain) contaminated with two fungicides (individually and in mixture). The following evaluation endpoints will be monitored in the experiment: physicochemical parameters, and phytoplankton, zooplankton, and macroinvertebrate communities. The results of the experiment will be used to experimentally demonstrate and to understand the mechanisms causing additive or non-additive (i.e. synergistic, antagonistic) effects at higher levels of biological organization (population, community). Furthermore, this study will be complemented by a literature review and meta-analysis to describe the extent to which (non)additive effects of binary pesticide mixtures have been observed in aquatic populations and communities tested in microcosm and mesocosm experiments and to study the prevalence of such responses across groups of species and contaminant levels. Finally, the outcomes of this literature review will be used to test the accuracy of the AI algorithms and mixture toxicity models, which can be used to assess the risks caused by contaminant mixtures measured in aquatic ecosystems worldwide.

Effects of Floc & Lock materials on cholinesterase and trypsin activity in benthic macroinvertebrates

Daniely de Lucena-Silva[1], Gustavo de Oliveira Porto[2], Juliana dos Santos Severiano[2,3], Daniele Jovem-Azevêdo[1,2,4], José Etham de Lucena Barbosa[2], Joseline Molozzi[2]*

[1]Programa de Pós-Graduação em Ciências Naturais e Biotecnologia, Universidade Federal de Campina Grande. Sítio Olho d'água da Bica, Zona Rural, CEP: 58175-000, Cuité, Paraíba, Brazil. [2]Departamento de Biologia. Programa de Pós-Graduação em Ecologia e Conservação e Programa de Pós-Graduação em Ciência e Tecnologia Ambiental, Universidade Estadual da Paraíba. Rua Baraúnas nº. 351 - Complexo Três Marias, Prédio de Biologia, Térreo - sala 10. Universitário, CEP 58.429-500, Campina Grande, Paraíba, Brazil. [3]Departamento de Biologia, Universidade Estadual de Maringá. Avenida Colombo, 5790, Jardim Universitário, CEP 87020-900, Maringá, Paraná, Brazil. [4]Instituto Federal da Paraíba, Acesso à Rodovia PB 426, S/N, Zona Rural, Sítio Barro Vermelho, CEP 58.755-000, Princesa Isabel, Paraíba, Brazil.

jmolozzi@gmail.com

The Floc & Lock (F&L) technique is a promising approach for mitigating and controlling eutrophication in freshwater ecosystems. However, gaps remain regarding its effects on benthic fauna directly exposed to the applied materials. In this study, we evaluated the effects of the coagulants polyaluminium chloride (PAC) and lanthanum-modified bentonite (LMB) on the activity of the enzymes acetylcholinesterase (AChE), butyrylcholinesterase (BChE), and trypsin in the snail *Melanoides tuberculata* (Müller, 1774) (Mollusca: Thiaridae) and larvae of the insect *Chironomus sancticaroli* (Strixino & Strixino, 1981) (Insecta: Diptera). We tested the hypothesis that exposure to PAC and/or LMB alters the activity of these enzymes in benthic macroinvertebrates in a species-dependent manner. Under in vivo experimental conditions, enzymatic responses were assessed after 72 h of exposure to the following treatments: control (no materials), +PAC, +LMB, and the combined treatment +LMB and PAC. The results revealed significant alterations in enzymatic activity in both species. AChE was strongly inhibited in larvae, with reductions exceeding 90% in treatments containing PAC, whereas *M. tuberculata* showed a mean reduction of approximately 50%, indicating interspecific differences in physiological sensitivity. Trypsin activity increased under the combined treatment, suggesting a physiological response associated with digestive regulation in response to exposure to F&L. These results demonstrate that the application of the F&L technique can induce significant species-dependent alterations in the enzymatic biomarkers of benthic macroinvertebrates, underscoring the need to incorporate these biomarkers into ecological risk assessments for F&L applications in eutrophic reservoirs and supporting the environmentally safe implementation of this eutrophication mitigation strategy.

Beyond hatching success: Arsenic induces embryonic abortion in zooplankton dormant banks

Eloísa Ramos-Rodríguez[1,2]*, Carmen Pérez-Martínez[1,2], Sandra Elices-Sierra[1,2]

[1]Institute of Water Research, University of Granada, 18071 Granada, Spain. [2]Department of Ecology, University of Granada, 18071 Granada, Spain

eloisa@ugr.es

Despite their ecological importance, resting eggs are underutilized in aquatic ecotoxicology. In agricultural basins, arsenic (As) is a ubiquitous metalloid that threatens zooplankton dormant egg banks. We investigated As effects on the hatching dynamics of resting eggs from three common co-occurring rotifer species in coastal wetlands: *Brachionus quadridentatus*, *B. plicatilis* L (large)-morphotype and *B. plicatilis* SS (small size)-morphotype from Laguna Honda (SE Spain), a wetland impacted by greenhouse agriculture. In a factorial laboratory experiment, morphologically intact eggs isolated from surface sediments were exposed to a control and five nominal concentrations of As (50 µg/L, 150 µg/L, 250 µg/L, 1500 µg/L, and 2200 µg/L). We monitored daily hatching success (proportion of neonates successfully emerged) and the day of hatching. Additionally, the rate of embryonic abortion (the proportion of total eggs that deteriorated or contained fully developed embryos that failed to emerge) was recorded. Results showed significant baseline differences in hatching success (SS-*B. plicatilis* > L-*B. plicatilis* > *B. quadridentatus*). However, neither As nor species-toxicant interactions significantly affected final hatching success or timing. In contrast, embryonic abortion rates increased in a dose-dependent manner across all morphotypes. These findings suggest that while As does not alter hatching phenology or total emergence, it compromises embryonic viability. Such sublethal effects threaten the dormant egg bank's role as a genetic reservoir, potentially undermining the fundamental resilience mechanisms that allow zooplankton populations to persist in degraded environments.

Histopathological responses to acute exposure to arsenic and lead in juvenile *Ostrea edulis*

Pamela Ruiz[1]*, Iñaki Pipaón[2], Sergio Yago[2], Alejandro Mediavilla[2], Maite Martínez-Madrid[2], Kristina Arranz[2], Iñaki Urrutxurtu[2], Irrintzi Ibarrola[2], Leire Méndez-Fernández[2], Markel Montaño-Lekue[1]

[1]CBET+ Research Group, Department of Zoology and Animal Cell Biology, Faculty of Science and Technology, [2]Research Centre for Experimental Marine Biology and Biotechnology PiE-EHU, University of the Basque Country EHU, Areatza z/g, 48620 Plentzia, Bizkaia, Spain.

pamela.ruiz@ehu.eus

Recent studies have reported worrying levels of lead (Pb) and arsenic (As) contamination in the Mar Menor, a unique hypersaline lagoon in Europe. These metals can disrupt cellular integrity, metabolism, and reproduction in aquatic organisms. However, histological analyses remain underused for assessing their effects on bivalves like the flat oyster *Ostrea edulis*, a species selected for its bioremediation potential in metal-contaminated sites, such as the Mar Menor. The present study aimed to assess the histopathological alterations induced by different concentrations of Pb (10 to 200 µg/L) and As (5 to 300 µg/L) in juveniles of *O. edulis* following 72 hours of acute exposures. The evaluation of effects was measured by means of atrophy index, connective tissue development (CTD), gill structure integrity, gonad developmental stage (GI), gonad ratio, and other alterations (eosinophilic cells and parasites). Results showed no statistically significant differences between exposed and control groups for atrophy index, CTD, or gill structure index under either metal. However, Pb triggered a clear immunological response at low-intermediate concentrations, increased eosinophil infiltration in all studied organs. At the highest Pb concentrations, eosinophilic cells presence decreased suggesting a non-linear immune response with possible suppression or tissue damage. In contrast, As induced a more subdued and tissue-specific response, with low eosinophil infiltration in gills and only moderate increases in the digestive gland at select concentrations. Furthermore, both metals at high concentrations caused a possible effect of gametogenesis in the organisms by inducing spawning, indicating potential reproductive stress. Overall, the study highlights the value of histological as sensitive tools for detecting sublethal effects of metal contamination and reinforces concerns regarding the ecological vulnerability of *O. edulis* exposed to Pb and As pollution, that might compromise bioremediations efforts in the Mar Menor. Funded by the Basque Government (Grant to Consolidated Research Group, CBET+, IT1743- 22), MeTeOr project (EHU-N24/11, UPV/EHU).

Establishing a monitoring network for air pollution effects on aquatic ecosystems in Spanish National Parks

Manuel Toro[1]*, Almudena Domínguez[1], Neftalí Roblas[1], Rocio Alonso[2], Samuel Prieto-Benítez[2], Carlos Nuño[1], Jose Antonio de la Ossa[1], S. García[1], G. Cobo[1], M.P. Muñoz[1], R. Piqueras[1]

[1]Área de Medio Ambiente Hídrico, Centro de Estudios Hidrográficos (CEDEX), 28005 Madrid, Spain.
[2]Ecotoxicología de la Contaminación Atmosférica, CIEMAT, 28006 Madrid, Spain.

manuel.toro@cedex.es

The Spanish National Parks Network comprises 16 natural areas that form part of the European Natura 2000 network, 12 of which contain non-marine aquatic ecosystems with surface water present for at least several months of the year. As part of the Network's Long-term Monitoring and Assessment Plan for ecological aspects, the Spanish National Parks Authority (OAPN) has promoted the design of a programme to monitor air quality and its effects on ecosystems, including aquatic ones, as a key factor in global change that may affect their functioning. Initially, 16 monitoring stations (13 on rivers and 3 on lakes) were selected in 9 national parks, representing different types of aquatic ecosystems distributed across three biogeographical regions. At these sites, an instrumental and analytical monitoring protocol has been implemented to detect the possible entry of atmospheric pollutants into the water and their effects on ecosystems. A methodology consistent with the monitoring framework established by the ICP-Waters Monitoring Network of the Geneva Convention (Convention on Long-Range Transboundary Air Pollution; CLRTAP-UNECE) has been adopted, and most of the selected stations are expected to be incorporated into this international network. Physicochemical and hydrological monitoring at the stations is carried out monthly thanks to the collaboration of the National Parks' technical staff, while biological indicators (diatoms and benthic macroinvertebrates) are monitored annually. The programme also includes an analysis of the spatial representativeness of existing rural background air quality monitoring stations to determine their suitability for characterising air quality in national parks, complemented by local measurements of atmospheric deposition taken within the parks.

Effects of multiple stressors on stream microbial assemblages and decomposition

Mikel Bilbao*, Diana Rojo, Alberto Alonso, Javier Pérez, Urtzi Arteagabeitia, Luz Boyero

Landareen Biologia eta Ekologia Saila - Departamento de Biología Vegetal y Ecología (EHU)

mbilbao084@ikasle.ehu.eus

This thesis investigates how riparian loss of leaf litter diversity and agricultural water pollution influence microbial assemblages and the process of leaf litter decomposition in streams. In a microcosm experiment, leaf litter from five common riparian tree species commonly used in restauration (*Alnus glutinosa*, *Fraxinus excelsior*, *Salix atrocinerea*, *Populus nigra* and *Ulmus minor*) was incubated, both as monocultures and increasingly species-rich mixtures, under two water treatments: unpolluted (control) and agricultural land use affected (impacted). We measured litter mass loss, quantified aquatic hyphomycetes sporulation and diversity, and counted culturable bacteria (CFUs). Decomposition proceeded faster in microcosm with water from the impacted reach, suggesting that nutrient pollution stimulated microbial activity. Litter mixtures generally decomposed faster than monocultures, although the relationship was not strictly linear; notably, a 3-species mixture exhibited the highest mass loss under enriched conditions. Aquatic hyphomycetes sporulation and diversity were similarly influenced more by water chemistry than by litter diversity. By contrast, CFU counts tended to decline with increasing litter diversity. These findings suggest that nutrient enrichment can mask or override the effects of biodiversity. Our results imply that, in streams exposed to nutrient enrichment, the increase of riparian plant litter diversity alone may not enhance ecosystem functioning. Instead, the effective management of riparian forests should address both species-specific traits (such as leaf nutrient content) and water quality, as nutrient loading can substantially alter microbial communities and organic matter processing in stream ecosystems.

The role of network fragmentation in prokaryotic taxonomic and functional composition: an experimental approach

Anna Equisuany[1], Dani Boix[1]*, Ada Pastor[1], David Cunillera-Montcusí[2], Carla Olmo[3], Anna Maria Romaní[1], Stéphanie Gascón[1]

[1]GRECO, Institute of Aquatic Ecology, University of Girona, Girona, Spain. [2]IFREMER–DYNECO/LEBCO, Centre de Bretagne. France. [3]Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, València, Spain

dani.boix@udg.edu

Spatial connectivity and dispersal are key drivers of metacommunity assembly, influencing biodiversity patterns across landscapes. However, changes in ecosystem connectivity, such as habitat fragmentation, pose a significant threat to these dynamics, as well as to the maintenance of biodiversity and functionality. Their contribution to the configuration of prokaryotic metacommunities has been overlooked, as the environment is so determining for these communities that it dampens their role. In this study, we experimentally test the effects of metacommunity connectivity loss on taxonomic diversity in prokaryotic metacommunities, and assess whether taxonomic patterns correspond to functional changes. Three experimental networks (i.e. metacommunities) structured along an isolation gradient were subjected to a network fragmentation treatment: Control (no fragmentation), Modular, and Strong fragmentation. Prokaryotic biodiversity was assessed using DNA metabarcoding, while microbial functional diversity was evaluated through community-level physiological profiles based on carbon substrate utilization. Under Strong fragmentation, taxonomic richness decreased, and compositional dissimilarities increased, whereas Modular fragmentation weakened isolation effects. Functional profiles were partially decoupled from taxonomy. This study highlights the pivotal role of connectivity loss in shaping prokaryotic metacommunities through dispersal limitation.

Taking the pulse of the Amazon: a basin-scale environmental integrity index for freshwater ecosystems

Andrea C. Encalada[1]*, Sharmin Siddiqui[1], Christian Suárez-Herrera[1], Daniel Escobar-Camacho[1], Daniela Rosero-López[1], Ayan Fleisham[2], Mariana Varese[3]

[1]Universidad San Francisco de Quito, Global Research and Solucions Center, Quito, Ecuador. [2]Instituto de Desenvolvimento Sustentável Mamirauá, Tefé, Brazil. [3]Wildlife Conservation Society WCS, Of. Regional, Lima, Perú

aencalada@usfq.edu.ec

Amazonian freshwater ecosystems sustain the world's richest freshwater biodiversity, regulate continental hydrology, and support the livelihoods and cultures of more than 30 million people. Yet no consistent, basin-wide framework exists to evaluate their condition. Our objective is to assess the state of Amazonian aquatic ecosystems through the calculation of an Environmental Integrity Index (EII), a spatially explicit tool integrating ecosystem structure and function across the entire basin (~7.3 million km²). The index used HydroBASINS Level-5 sub-basin layers (~109 units) as the spatial framework and integrates 27 indicators derived from open- access, regularly updated datasets. Structural components include longitudinal connectivity (Dendritic Connectivity Index), hydrological regime metrics (flow magnitude, flood duration, extreme low flows), and water-level anomalies. Functional components include riparian vegetation buffers (50–500 m), basin-wide natural vegetation cover, water surface temperature trends derived from Landsat imagery, and sediment anomalies. Indicators were normalized, weighted through expert consultation, and aggregated into composite structural and functional scores. Acknowledging the challenge of identifying long-term regional biodiversity monitoring data, we paired our index with robust, spatially consistent ecological datasets—including fish richness and migratory species distributions—to identify areas where freshwater species may benefit from increased research, monitoring, and conservation programs. Lower integrity values are associated with river fragmentation from hydropower dams, altered flood regimes driven by flow regulation and climate variability, upstream deforestation reducing riparian buffers, sediment instability, and rising water temperatures. These pressures are concentrated in the Upper Madeira, Tocantins, and Andean–Amazon transition zones, whereas higher integrity persists in parts of the western Amazon and along mainstem corridors. In a basin where real-time ecological monitoring remains sparse and uneven, the framework is designed to support the creation of a new regional and local participatory monitoring network, enabling co-validation, improved data generation, and stronger evidence-based freshwater governance across the Amazon.

Afección de la DANA de octubre de 2024 sobre la calidad de las masas del agua

Miriam Ibáñez[1]*, Lorena Martínez[1], Susana Fernández[2], Concha Durán[2]

[1]Eurofins Iproma, 46025, Valencia, España. [2]Confederación Hidrográfica del Júcar, 46010, Valencia, España

miriam.ibanez@etib.eurofins.com

El 29 de octubre de 2024 un episodio extraordinario de precipitaciones afectó al Levante peninsular provocando acumulados históricos en la Comunitat Valenciana. Este fenómeno meteorológico extremo provocado por una DANA (Depresión Aislada en Niveles Altos) causó graves inundaciones como consecuencia del desbordamiento de ríos y barrancos. Los impactos inmediatos de esta situación en nuestra sociedad fueron significativos, muchos de ellos de tipo material con ingentes pérdidas económicas, pero sin duda, los más graves han sido los sufridos por la población general y la pérdida de más de doscientas vidas humanas. El impacto sobre los cauces y las comunidades acuáticas, como consecuencia del arrastre de materiales y modificaciones en la hidromorfología fue directo y notable. Además, al impacto puntual de la riada se unen el efecto acumulado del vertido de aguas residuales sin depurar que durante meses han llegado a los cauces por la rotura de las infraestructuras de saneamiento de aguas residuales. El objetivo de este trabajo es evaluar como la DANA ha afectado a los indicadores de calidad biológicos empleados para evaluar el estado ecológico de las masas de agua de tipo río (macroinvertebrados, diatomeas, macrófitos y peces). Para ello se comparan los resultados obtenidos en las redes de seguimiento de la Confederación Hidrográfica del Júcar en los cauces afectados, antes y después de 2024. Permitiendo evaluar cómo estas comunidades son capaces de responder y adaptarse a los fenómenos meteorológicos extremos cada vez más frecuentes.

Biodiversity responses to fragmentation in experimental eukaryotic metacommunity networks

Anna Equisuany[1], Carla Olmo[2]*, Dani Boix[1], David Cunillera-Montcusí[3], Jordi Sala[1], Stéphanie Gascón[1]

[1]GRECO, Institute of Aquatic Ecology, University of Girona, Girona, Spain. [2]Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, València, Spain. [3]IFREMER–DYNECO/LEBCO, Centre de Bretagne. France

carla.olmo@uv.es

Connectivity is a central concept in ecological theory, yet the mechanistic pathways through which different forms of fragmentation affect pond biodiversity remain insufficiently understood. To evaluate biodiversity responses of eukaryotic metacommunities under contrasting fragmentation scenarios, we conducted an outdoor mesocosm experiment simulating pond networks. We established three experimental metacommunities, each structured along a spatial centrality gradient. Two of these metacommunities were subjected to distinct fragmentation treatments: (1) modular fragmentation, in which the network was divided into three interconnected modules; and (2) strong fragmentation, in which central and peripheral mesocosms were completely disconnected. The third metacommunity (3) was maintained as a control. Focusing on autotrophic microeukaryotes, heterotrophic microeukaryotes, and invertebrates, we combined DNA metabarcoding with traditional taxonomic identification methods to characterize community composition. Our results revealed consistent effects of fragmentation across the three groups analysed. Strong fragmentation, which increased community isolation, led to declines in local (alpha) diversity. Regional (gamma) diversity was also influenced by fragmentation type. Notably, the control metacommunity did not consistently exhibit the highest gamma diversity; instead, its values generally fell between those observed in the modular and strongly fragmented networks. Overall, these findings highlight the importance of explicitly quantifying spatial connectivity in ecological research. Given the ongoing loss of connectivity in freshwater systems, understanding how network structure shapes biodiversity across spatial scales is essential for predicting and mitigating the impacts of fragmentation in metacommunity contexts.

Microbial connectivity across a wildfire-affected Mediterranean catchment

Adrián Sánchez-Maestro[1]*, Beatriz García-Béjar[2], Francisco Castillo[1], Nicolas Valiente[1]

[1]Department of Science and Agroforestry Technology and Genetics, ETSIAMB, University of Castilla-La Mancha, 02071, Albacete, Spain. [2]Department of Analytical Chemistry and Food Technology, Faculty of Chemical Sciences and Technologies, University of Castilla-La Mancha, 13071, Ciudad Real, Spain

adrian.smaestro@uclm.es

Wildfires are becoming more frequent and severe in Mediterranean regions due to climate change and land-use pressures, with important consequences for river catchments. By altering vegetation cover, soil structure, and erosion dynamics, fires can increase the mobilization of nutrients and microorganisms from burned hillslopes to adjacent streams, potentially reshaping microbial communities across the terrestrial–freshwater continuum. These disturbances may also modify hydrological and microbial connectivity within catchments, enhancing the transfer of microorganisms and nutrients from soils to freshwater systems and potentially altering ecosystem functioning at the catchment scale. However, how wildfire affects microbial communities across soils and streams in Mediterranean catchments remains poorly understood. Here we tested the hypothesis that wildfire alters microbial community composition and functional potential across catchments, leading to detectable shifts along hillslope–stream gradients and between upstream, burned, and downstream sections of river networks. To investigate this, we surveyed microbial communities in the Huso River catchment (Toledo province, Castilla-La Mancha, Spain), affected by the La Estrella wildfire in August 2024, which burned more than 2,500 ha. Sampling was conducted in April 2025 at four cross-sections along the river: two upstream of the burned area, one within the affected catchment, and one downstream. At each cross-section, three surficial soil samples (<3 cm depth) were collected along a hillslope gradient, together with one stream water sample, resulting in 12 soil samples and 4 water samples. Microbial community composition was characterized using 16S rRNA gene (V3–V4) and ITS1 amplicon sequencing. In addition, shotgun metagenomics was used to explore the functional potential of microbial communities, with particular emphasis on nitrogen cycling genes. Preliminary analyses reveal significant differences in both community composition and functional potential among cross-sections and along the hillslope gradient, highlighting the influence of wildfire on microbial connectivity and ecosystem processes across the catchment.

Biogeographical distribution of freshwater macroinvertebrate invasive species in the catchments of Central Portugal

Pieter van der Linden*, Maria João Feio

Department of Life Sciences / FCTUC, Marine and Environmental Sciences Centre (MARE), Associate Laboratory ARNET, University of Coimbra, Coimbra, Portugal

pvdlinden@uc.pt

Freshwater ecosystems are among the most biodiverse, yet also the most threatened ecosystems worldwide. Invasive Alien Species (IAS), including freshwater invertebrates, are a major driver of ecological change, with profound consequences for biodiversity, ecosystem functioning, and human well-being. The Iberian Peninsula has experienced a particularly rapid increase in invasive freshwater macroinvertebrates, driven by its biogeographic position, Mediterranean climate, intensive human pressure, and extensive river regulation. Climate change is expected to further exacerbate these invasions by facilitating range expansions, increasing establishment success, and intensifying impacts on native communities. Despite this growing threat, Portugal lacks a national-scale, predictive understanding of the distribution patterns (hotspots) of established freshwater IAS. This study aims to fill this critical knowledge gap by identifying current invasion hotspots and assessing historical changes within the catchments of Central Portugal using historical databases collected in the past 25 years. Within the Mondego, Vouga and Lis catchments, we found a total of 5 blacklisted freshwater IAS: the red swamp crayfish *Procambarus clarkii*, the Asian clam *Corbicula fluminea*, the North American crangonyctid amphipod *Crangonyx pseudogracilis*, the New Zealand mud snail *Potamopyrgus antipodarum*, and the tadpole snail *Physella acuta*. All species were recorded in the Mondego and Vouga catchments, whereas in the Lis Catchment we found 3 species: *P. antipodarum*, *P. acuta* and *C. pseudogracilies*. *C. pseudogracilis* was first recorded in Portugal in 2011 and found in Mondego and Lis since 2017. The other 4 species were already present 25 years ago. *P. clarkii* was mostly found < 40 km from the sea, however, in 2025 we also found a specimen 140 km upstream from the river mouth. By identifying hotspots of invasive species and assessing temporal changes, this study contributes to an evidence-based early-warning framework for the detection, and management of invasive freshwater macroinvertebrates in Portugal.

Best practices for ecologically oriented urban river and stream restoration under a One Health framework

Marcos Dias*, Sonia Serra, Maria João Feio

Department of Life Sciences, University of Coimbra and MARE - Marine and Environmental Sciences Centre, ARNET – Aquatic Research Network, Calçada Martim de Freitas, 3000-456 Coimbra, Portugal

marcos.dias@uc.pt

River restoration has become a well-established field of scientific research and professional practice, building on a long tradition of modifying freshwater ecosystems to meet economic and societal needs. In Europe, the implementation of the Water Framework Directive marked a decisive transition toward ecologically oriented river restoration, emphasizing ecological objectives and the use of restoration as a tool to meet legislative and policy requirements. This is now reinforced by the EU Nature Restoration legislation. This study reviewed and compiled best practices for the rehabilitation and restoration focused on particular constraints of urban rivers and streams. The proposed measures aim to support the recovery of ecological integrity and the achievement of good ecological status, thereby contributing to the protection of human, animal, and environmental health within a One Health framework in urban ecosystems. The study provides an overview of the main pressures affecting urban rivers and streams and presents a structured catalogue of measures addressing morphological, hydrological, chemical, ecological, and social dimensions. Emphasis is placed on nature-based and ecosystem-based approaches that prioritize the re-establishment of natural structures and processes, enhance ecosystem resilience, and promote long-term sustainability. The catalogue of measures elaborated follows a hierarchical framework to guide the selection of measures, ranging from fundamental actions such as pollution control and riparian vegetation restoration to structural interventions, social measures, and complementary strategies adapted to urban constraints. Each measure is characterized in terms of objectives, applicability, ecological benefits, limitations, and contributions to ecosystem services and human well-being. To bridge theory and practice, the work also includes case studies from cities worldwide, illustrating implementation experiences, challenges, and lessons learned. Limitations were also addressed in urban settings, and guidance is provided for context-specific application. This work was done within the context of the Horizon Europe OneAquaHealth project.

Comparing carbon dynamics in a restored and a naturally regenerated coastal wetland

Silvia Gabarrón-Boudia[1]*, Paula Warren-Jiménez[1], Sofía Rodríguez-Gómez[1], Miriam Ruiz-Nieto[1], Teresa Gil-Gil[2], Enrique Moreno-Ostos[1]

[1]Ecology and Geology Department, University of Málaga (UMA), Av. De Cervantes 2, 29071 Málaga, Spain.
[2]World Wildlife Fund España (WWF/ADENA), Gran Vía de San Francisco 8D, 28005 Madrid, Spain.

silviapd4@gmail.com

Coastal wetlands play a crucial role in climate change mitigation due to their capacity to sequester blue carbon. Their degradation has triggered numerous restoration efforts, whose effectiveness remains uncertain, especially during early stages. This study analyzes and compares carbon dioxide (CO_2) fluxes and sediment variables in two drained wetlands in Trebujena (Cádiz): one actively restored (R) after desiccation and another non-restored, naturally regenerated (NR). CO_2 fluxes were measured, along with sediment variables including moisture, salinity, sediment temperature, inorganic carbon (IC) and organic matter (OM) contents. Vegetation cover and physiological state were also assessed using remote sensing. XXIII congreso, Bilbao, del 22 al 26 de junio de 2026 The R wetland sediments showed higher OM content, possibly due to greater organic input during dry periods. Conversely, the NR wetland showed higher IC content, likely due to greater sediment stability. The main drivers of CO_2 fluxes were salinity in the NR wetland and sediment moisture in the R wetland. Overall, the R wetland acted as a net CO_2 emitter, whereas the NR wetland behaved as a carbon sink. These findings reflect a common paradox in ecological restoration: structural recovery does not necessarily imply immediate functional restoration. Improving vegetation cover and stabilizing the hydrological regime will be key actions for enhancing the design and monitoring of future restoration projects.

Patrones de movilidad del zooplancton como rasgos funcionales

Rodrigo Gonçalves[1,2]*, Emilio Moreno[1], Sandra Elices[1]

[1]Departamento de Ecología, Fac. Ciencias, Universidad de Granada, 18071, Granada, España. [2]Research Unit Modeling Nature (MNat), Universidad de Granada, 18071 Granada, España

rogo@ugr.es

El movimiento del zooplancton (ej. cladóceros, copépodos, rotíferos) integra un número de procesos simultáneos, pero que responden a distintos rasgos funcionales: modo de alimentación, escape/detectabilidad ante la presencia de un depredador, respiración, alimentación (ingestión y búsqueda de alimento), encuentro con congeneres (competencia directa, efectos densodependientes) y encuentro con el sexo opuesto para apareamiento. A pesar de estar presente en los procesos ecológicos, el movimiento ha sido tradicionalmente difícil de estudiar cuantitativamente porque requiere de tecnología no estándar para 1) la adquisición de datos y 2) el análisis de grandes cantidades de información. En el caso de 1) algunos organismos (ej. copépodos) se mueven con una velocida mayor a lo que puede resolver una cámara de video convencional, por lo tanto hemos utiilzado cámaras de alta velocidad que pueden obtener mucha mayor resolución (ej. 1500 FPS). Respecto a 2) la cantidad de datos generados requiere un tratamiento desde el punto de vista semi-automatizado para reconstruir las trayectorias de múltiples individuos, para lo cual se uitlizan herramientas de computer vision, en particular particle tracking velocimetry (PTV). Para el análisis de las trayectorias y detectar patrones se utilizan herramientas de machine learning para lograr clasificar los individuos y encontrar patrones que a simple vista (o con análisis más simples) no son detectables. En una primera aproximación utilizamos distintas especies de *Daphnia* y con datos preliminares mostramos la potencialidad de este tipo de estudios para estudios eco-evolutivos, toxicología, defensas inducibles y muchas otras otras líneas de investigación.

Aplicación del concepto de campo de fetch espacialmente distribuido en el Lago Titicaca, Peru

Marcelo Marques[1]*, Alejandro Victor Hidalgo Valdivia[2], Elaine Patricia Arantes[3], Marcelo Rosolem Luchetti[1]

[1]Universidad Estadual de Maringá, Umuarama, Paraná, Brasil. [2]Universidad Católica de Santa Maria (UCSM), Arequipa, Peru. [3]Universidad Estadual del Paraná (UNESPAR), Apucarana, Paraná, Brasil

marcelomarques100@gmail.com

La modelación computacional constituye una herramienta esencial para la comprensión de la dinámica hidrodinámica en lagos y embalses. Sin embargo, la dependencia de softwares especializados, licencias costosas y equipos altamente capacitados limita su aplicación amplia en limnología, especialmente en regiones con restricciones estructurales. En este contexto, el concepto de campo de fetch, originalmente desarrollado para análisis comparativos bidimensionales, se presenta como una alternativa metodológica capaz de mantener precisión y exactitud con mayor simplicidad operativa. El presente estudio aplica la metodología integral del método de Saville en alta resolución, conforme al perfeccionamiento propuesto en trabajos anteriores, al Lago Titicaca, sistema de gran relevancia limnológica en América del Sur. La discretización espacial permitió la determinación del fetch máximo para 16 direcciones principales de viento. Los resultados indicaron valores máximos que variaron entre 57,1 km (SW) y 79,2 km (SE), con una media direccional de 68,58 km. Se observa predominio de mayores longitudes de fetch en los cuadrantes sur y sudeste (SSE = 77,1 km; SE = 79,2 km), lo que sugiere un mayor potencial de generación de olas progresivas bajo esas direcciones. Las direcciones oeste-suroeste presentaron los menores valores relativos, reflejando la geometría marginal del lago. El análisis evidencia que el campo de fetch proporciona una representación espacial continua y físicamente coherente de la pista de viento, siendo particularmente útil tanto para estimaciones paramétricas simplificadas de la altura significativa de ola (Hs) como para la parametrización de modelos hidrodinámicos más sofisticados. Se concluye que el concepto de campo de fetch representa una herramienta metodológica robusta y accesible, contribuyendo a democratizar los análisis hidrodinámicos en sistemas lacustres complejos y promoviendo el avance técnico-científico de la limnología ibérica y latinoamericana.

Nuevos índices de macrófitos en ríos ibéricos

Pedro Tomás[1], José Luis Moreno[2], Celia Mora[3], Juan Alández[4]

[1]Laboratorio de Ensayos Técnicos, S. L. Cuarte de Huerva (Zaragoza). [2]Escuela Técnica Superior de Ingeniería Agronómica y de Montes y Biotecnología, Universidad de Castilla-La Mancha, Albacete. [3]Tragsatec, Planificación y Gestión Hídrica, Madrid. [4]Área de Vigilancia y Control de Calidad de las Aguas. Subdirección General de Protección de las Aguas y Gestión de Riesgos. Dirección General del Agua. Ministerio para la Transición Ecológica y el Reto Demográfico

biologia@ensaya.es

El desarrollo de índices biológicos basados en macrófitos en ríos ibéricos ha estado condicionado por una elevada casuística, heterogeneidad metodológica y limitada reproducibilidad espacial y temporal, generando incertidumbre en la clasificación del estado ecológico. En este contexto, se presenta el proceso de diseño y validación nuevos índices de macrófitos adaptados a los ríos de la Península Ibérica, fundamentados en campañas realizadas entre 2018 y 2023. El trabajo integra 3.821 puntos de muestreo y 9.967 inventarios procedentes de distintas redes (NABIA, REFCON, ACA y CCAA), junto con datos físico-químicos, de usos del suelo, IMPRESS, hidromorfológicos y variables bioclimáticas. Se realizaron procesos de depuración de estaciones y taxones (actualización TAXAGUA), estandarización de formatos y unidades, eliminación de duplicados y verificación de coherencia espacial. El inventario de partida incluye más de 1.100 taxones registrados en el periodo 2018–2023, con análisis de frecuencia por tipología fluvial y elaboración de matrices de depuración basadas en criterios taxonómicos, ecológicos y funcionales. Los nuevos índices incorporarán: (i) una lista taxonómica revisada y simplificada, centrada en taxones acuáticos sumergidos y fácilmente identificables; (ii) valores indicadores recalibrados a partir de concentraciones de nutrientes (N y P totales) coincidentes temporalmente con el muestreo biológico; (iii) escalas de abundancia en cinco niveles para porcentaje de cobertura y número de colonias, reduciendo la subjetividad en campo; y (iv) la exploración de enfoques multimétricos y funcionales basados en rasgos (traits). Matrices de similitud de distancia ecológica a comunidades de referencia.

Monitorización remota y gestión avanzada del estado trófico en embalses mediante la metodología de "Data Fusion" (Proyecto DAMTAQ)

Beatriz Villazán Peñalosa[1]*, Javier Granero-Castro[1], Javier Cordón Ezquerro[1], Amando Escudero Marina[1], Samuel Cabiedas Sánchez[1], Ruben Usamentiaga Fernández, Pedro de Arquer Fernández, Sara Rico Rivero, Juan Luis Carus Candas.

[1]TAXUS MEDIO AMBIENTE S.L.; [2]TSK S.L; [3]Unversidad de Oviedo

bvillazan@taxusmedioambiente.com

La garantía de la calidad de los recursos hídricos continentales es un desafío crítico para la sociedad actual, especialmente ante el fenómeno de la eutrofización cultural derivado de presiones antrópicas y los efectos del cambio climático. Tradicionalmente, la caracterización limnológica de estas masas de agua se ha basado en muestreos puntuales e in-situ que, aunque precisos, presentan elevados costes, baja frecuencia temporal y una cobertura espacial limitada para embalses de gran extensión. En este trabajo se presentan los resultados finales del proyecto DAMTAQ, cuyo objetivo central es la monitorización remota y continua de la calidad del agua mediante un enfoque integral de fusión de datos (data fusion). La metodología combina el uso de sensórica de bajo coste desplegada en boyas flotantes autónomas con técnicas avanzadas de teledetección satelital. Para la monitorización in-situ, se seleccionaron sondas multiparamétricas (modelo AP-6000) capaces de medir parámetros clave como temperatura, pH, oxígeno disuelto, turbidez y clorofila-a en tiempo real. El sistema integra comunicación 4G y alimentación mediante paneles solares, garantizando autonomía y transmisión de datos en entornos naturales. Paralelamente, se explotaron imágenes del satélite Sentinel-2 procesadas mediante Google Earth Engine, analizando índices hiperespectrales normalizados como MCARI, NIRv, DVI y WDVI. La innovación principal radica en la aplicación de modelos de Machine Learning y Deep Learning para la clasificación de estados tróficos. Los experimentos demostraron que el modelo YOLOv8m alcanzó una precisión equilibrada (balanced accuracy) de 0.8917, optimizando la discriminación remota entre estados eutróficos y no eutróficos. En conclusión, la metodología DAMTAQ se posiciona como una herramienta escalable y eficiente para los organismos de cuenca y gestores, facilitando la toma de decisiones ambientales y permitiendo un seguimiento del estado ecológico alineado con la Directiva Marco del Agua.

DIAT-PANG! Blowing bubbles to decode diatom index performance in river bioassessment

Mikel Zaragüeta[1]*, Teresa Conejo-Orosa[1], Alfonso Nebra[1], Jose Antonio Palomino[1], Amaia Pérez-Bilbao[1], Matilde Segura[1], David García[1], Adrián Martínez[1], Agustín García[1], Paula Arranz[1], Pedro Manrique[1], Marina Moreno[1], Mario Romero[1], Sara Guerrero[1], Paulo Nantes[1], Yamil Jiménez[1], Alba Pereira[1], José Miguel Rodríguez[1], Romina Álvarez-Troncoso[2]

[1]Eurofins Cimera, C/Santiago Grisolía, 2 (Parque Tecnológico de Madrid), 28760, Tres Cantos, Madrid, Spain.
[2]University of Vigo, Campus Lagoas Marcosende, 36310, Vigo, Pontevedra, Spain

mikel.zaragueta@etib.eurofins.com

Diatoms are a fundamental bioindicator for assessing ecological condition under the EU Water Framework Directive. The IPS, an index defined in France, has been used to establish quality boundaries and to calculate ecological status. However, applying metrics designed in other regions can lead to discordance between expected and observed classifications in local areas. In this context, IDIAT index was introduced in 2016 as a metric adapted to Iberian conditions, based on ecological distance and on the position of communities along the pressure gradient. Recently, IDIAT2 has been developed as a recalibrated and robust version of this index. Explaining diatom-index behaviour is often difficult. Thus, understanding how species autoecologies influence index responses sometimes requires intuitive visualisation. In this study, we developed DIAT-PANG!, an interactive visualisation system to explore how diatom assemblage structure translates into IPS and IDIAT2 scores. Through a QR-linked web application, users can select taxa represented as bubbles within a scatter-plot with real-time computation of index values as species composition changes. To contextualise index performance, IPS and IDIAT2 metrics were analysed using a diatom database including inventories from all Spanish river basins sampled from 2018 to 2023. From this dataset, we selected 328 representative taxa (frequency of appearance >1% and cumulative abundance >100 valves), calculating cumulative abundances and linking their corresponding autoecologies. The tool is particularly suited for technical training and stakeholder communication. But also, to demonstrate pressure–response dynamics with different diatom assemblages. Through an intuitive, model-driven interface, DIAT-PANG! facilitates clearer interpretation of diatom-based ecological river assessments.

WAVE: base de datos integrada de calidad del agua y salud pública en Europa

M. Leira[1]*, S. Hylander[2], A. Mandal[3], C. Iannizzi[4]

[1]Universidad de Santiago de Compostela, España. [2]Linnaeus University, Suecia. [3]University of Birmingham, Reino Unido. [4]University of Cologne, Alemania

manel.leira@usc.gal

El vínculo entre la salud de los ecosistemas acuáticos y la salud humana está bien establecido conceptualmente (OneHealth), pero la falta de bases de datos integradas a escala regional impide análisis cuantitativos robustos. Presentamos WAVE (Water, Alliance for Vital Ecosystems), un proyecto EUniWell que desarrolla la primera base de datos transnacional que integra calidad fisicoquímica del agua dulce, indicadores ecológicos (DMA) y datos de salud pública a escala NUTS-2/3 en Europa. Integramos datos de WISE Waterbase (ríos y lagos), WISE-WFD (estado ecológico), EUROSTAT (mortalidad/morbilidad por causas), WHO Europa, ECDC (enfermedades infecciosas) y European Social Survey (bienestar mental) para 2010-2023. Cobertura geográfica: ~900 regiones NUTS en España, Portugal, Reino Unido, Alemania y Suecia. Parámetros ambientales seleccionados (n=12-20): físico-química básica (O_2, pH, temperatura, conductividad), nutrientes (NO_3-N, NT, PO_4-P, PT), contaminación orgánica (BOD_5, COD), biomasa algal (clorofila-a) y estado ecológico WFD. La armonización espacial emplea técnicas geoestadísticas (spatial join point-to-polygon, agregación zonal para datos raster) para asignar valores a regiones NUTS. La armonización temporal agrega datos sub-anuales mediante estadísticos robustos (media, mediana) con métricas de cobertura temporal. El control de calidad sigue ISO 19157: evaluación de completitud espacial-temporal, validación de rangos lógicos, detección de outliers (método IQR), análisis de consistencia espacial y validación cruzada entre fuentes. Todos los datos reciben flags de calidad (excelente/bueno/aceptable/pobre) basados en completitud, cobertura temporal y validación estadística. La base de datos v1.0 comprende >500,000 observaciones con cobertura espacial del 76% (NUTS-3) y completitud temporal media de 9.5 años (68% regiones con ≥8 años). El 81% de los datos tienen calidad "buena" o "excelente" según criterios de completitud y consistencia. WAVE proporciona infraestructura de datos abiertos (CC-BY 4.0, Zenodo) para investigación OneHealth, gestión basada en evidencia de recursos hídricos, y evaluación de servicios ecosistémicos acuáticos. Financiación: EUniWell Seed Funding Call 9

Cuando el índice no responde: desafíos en la evaluación ecológica de humedales

Amaia Pérez-Bilbao*, Alfonso Nebra, Mikel Zaragüeta, Alba Pereira, Paulo Nantes, Jose Miguel Rodríguez

Eurofins Cimera, C/Santiago Grisolía, 2 (Parque Tecnológico de Madrid), 28760, Tres Cantos, Madrid, Spain

Amaia.Perez@etib.eurofins.com

El IBCAEL es un índice biológico basado en macroinvertebrados acuáticos que se utiliza en la evaluación de estado ecológico (EE) en masas de agua tipo lago. Tal como indica el RD 817/2015, se encuentra pendiente de intercalibración y sus valores de condición de referencia se obtuvieron con elevada incertidumbre estadística. Desde su desarrollo en el año 2011 y su posterior implementación a nivel nacional en 2013, no se ha revisado en profundidad, lo que reduce la fiabilidad de sus resultados en la evaluación del EE. En el contexto de los trabajos de seguimiento del estado ecológico de humedales llevados a cabo por la Agencia Vasca del Agua/URA durante los últimos años, esta carencia se ha puesto de manifiesto en varias ocasiones. En general, los bajos valores de IBCAEL vienen dados por la métrica ABCO, basada en la abundancia de especies de microcrustáceos indicadoras de la tipología. Es habitual que masas de agua con comunidades biológicas ricas y con elevada diversidad presenten valores de ABCO muy bajos o nulos, subestimando el estado ecológico real de la laguna. El objetivo de este trabajo es llevar a cabo una revisión del IBCAEL utilizando los datos recopilados entre 2017 y 2025 en lagunas del País Vasco. Para mejorar el desempeño del índice, se plantea la incorporación en los listados de aquellas especies que aparecen de forma recurrente en cada lago, así como la resolución taxonómica a nivel de género, con el fin de aumentar la precisión ecológica del indicador. Asimismo, se propone simplificar la clasificación de tipologías, como ocurre en el QAELS (índice precursor del IBCAEL). Finalmente, se considera necesaria una revisión y ampliación de los taxones indicadores de tipología, garantizando que el conjunto de organismos represente adecuadamente la variabilidad biológica de las lagunas y contribuya a una evaluación del EE más fiable.

Do European cities share common urban stream stressors? A macroinvertebrate-based assessment across four urban regions

Ana Raquel Calapez[1]*, Marcos Dias[1], Janine Pereira da Silva[1], Fernanda Rodrigues[1], Andreina Zerega[1], Pieter van der Linden[1], Rayan Bouchalli[2], Emilie Chardon[2], Morgan Canévet[2], Dirk Schmeller[2], Marie Anne Eurie Forio[3], Peter Goethals[3], May Linn Bokma Mørch[4], Silje H. Henni[4], Anne Moen[4], Leonard Sandin[5], Maria João Feio[1]

[1]MARE/ARNET, Department of Life Sciences, Faculty of Science and Technology, University of Coimbra, Coimbra, Portugal. [2]Université de Toulouse, Toulouse INP, CNRS, IRD, CRBE, Toulouse, France. [3]Department of Animal Sciences and Aquatic Ecology, Ghent University, Ghent, Belgium. [4]University of Oslo, Institute of Health and Society, Department of Public Health Science, Oslo, Norway. [5]Norwegian Institute for Nature Research (NINA), Sognsveien, Oslo, Norway

anacalapez@uc.pt

Urban freshwater ecosystems are increasingly affected by multiple anthropogenic pressures with implications for biodiversity, ecosystem functioning and human well-being. Understanding which and whether there are common stressors leading to ecological degradation across different biogeographic and climatic contexts is essential for developing urban management plans within a One Health framework. Taking this into consideration, we analyzed macroinvertebrate communities from 78 urban streams across four European cities (Coimbra, Toulouse, Ghent and Oslo) assessing taxonomic composition, diversity metrics (richness, Shannon diversity and evenness) and ecological quality (BMWP index) and assessed which environmental variables best explain community variation. Macroinvertebrate community composition differed significantly between cities (PERMANOVA, $p<0.05$) demonstrating strong regional and biogeographic structuring. In contrast, diversity metrics showed no significant differences (PERMANOVA, $p=0.068$) suggesting high similarity in diversity patterns across urban streams despite taxonomic turnover. Ecological quality (BMWP) differed significantly among cities (Kruskal-Wallis test, $p < 0.05$), with Ghent consistently scoring lower compared to the other research cities. Despite these compositional and ecological quality differences among cities, environmental modelling (DISTLM, explaining 56% of biological variation) identified nutrient-related and urban-associated variables as the main drivers of ecological responses. Total phosphorus explained the largest proportion of community variation, followed by latitude, artificial light at night exposure, nitrate concentration and mean water depth. These findings reveal the coexistence of context-dependent community composition and widely shared urban stress patterns. While regional factors influence community structure and ecological quality, nutrient and light-related pressures appear to represent generalisable drivers of urban freshwater degradation. Accordingly, addressing these pressures may provide cross-regional benefits within a One Health perspective linking ecosystem integrity to biodiversity preservation and human well-being.

Analizando los valores plurales de los ríos secos: entrevistas a pie y fotovoz

Andrea Camila Romero Gutiérrez, Nestor Nicolás-Ruiz, Mª Luisa Suárez Alonso, Mª Rosario Vidal-Abarca Gutiérrez*

Departamento de Ecología e Hidrología. Universidad de Murcia, Campus de Espinardo, 30100, Murcia, España

charyvag@um.es

Los valores de la naturaleza son principios u opiniones que determinan la importancia del medio ambiente para el ser humano. Su importancia radica en que pueden ayudar a comprender mejor la relación del ser humano con su medio natural. Estos valores a menudo se han evidenciado en estudios sobre emociones y percepciones sociales. En la Región de Murcia, los ríos secos, que solo fluyen tras fuertes precipitaciones, son un paisaje característico, pero a menudo son ignorados y considerados ecosistemas de poco valor socio-ecológico. En el presente trabajo se propuso investigar las emociones, los valores plurales (con especial énfasis en los valores relacionales) y las percepciones sociales que los ríos secos generan en 22 estudiantes de la Facultad de Biología de la Universidad de Murcia. Se seleccionó la Rambla de La Murta para llevar a cabo la experiencia utilizando dos metodologías diferentes: “entrevistas a pie” y “fotovoz”. Los resultados mostraron que las emociones más asociadas a los ríos secos fueron la tranquilidad y la curiosidad. Se identificaron nueve valores de la naturaleza, donde predominan los valores instrumentales, seguidos de los relacionales e intrínsecos. Dentro de los relacionales, se manifestaron principalmente los valores de identidad cultural y administración eudaimónica. Se identificaron tres percepciones sociales: desconexión, hidrofilia y polarización. Este estudio muestra que los ríos secos evocan emociones y valores de la naturaleza positivos, pero también algunos negativos. Comprender estas perspectivas y sensaciones es fundamental para mejorar la relación de la población murciana con estos ecosistemas. Para ello es importante fomentar la educación ambiental, incentivar la participación ciudadana, perfeccionar las políticas ambientales y ser más exigentes con la gestión ambiental.

Impacts of lake drying on the dissolution of the sedimentary inorganic carbon sink

Mariella Olcese*, Camille Minaudo, Lidia Cañas, Daniel von Schiller, Biel Obrador

Department of Evolutionary Biology, Ecology and Environmental Sciences, University of Barcelona, 08028 Barcelona, Spain

mariella.olcese@ub.edu

Lakes are important carbon sinks due to the burial of both organic and inorganic carbon (IC), the latter related to largely unexplored pelagic precipitation linked to planktonic metabolism and geochemical constraints. In medium to high-alkalinity systems, the sedimentary IC pool is primarily driven by the deposition of authigenic calcite crystals and their subsequent dissolution, processes regulated by water chemistry (e.g., pH, alkalinity, calcium concentration) and CO_2 dynamics. However, drying is increasingly altering the hydrological regime of lacustrine systems, leading to declining water levels, contraction of surface area, and greater exposure of sediments to the atmosphere. The effects of these changes on the potential loss of the sedimentary IC stock remain poorly understood. More precisely, it remains unclear how drying intensification modulates calcite dissolution and the overall IC storage and fluxes. This knowledge gap on calcite cycling in lakes limits our mechanistic understanding of lake carbon dynamics under changing hydrological conditions. To address this, incubation experiments are conducted using surface lake sediment amended with synthetic ^{13}C-labeled calcite under two experimental conditions: permanently inundated and exposed to progressive drying. Dissolution rates are quantified using a combination of isotopic mass balances and compartment-specific carbon and calcium measurements across sediment, pore-water, overlying water, and headspace, together with respiration rates. We track these carbon pools to quantify dissolution rates and evaluate how they respond to sediment drying. The dissolution rates of sedimentary calcite are expected to be lower during drying than under inundated conditions, with rates decreasing as sediment drying progresses due to changing redox conditions. These experiments provide evidence of how drying modulates calcite dissolution and the role of carbonate sediments in the lake carbon cycle, offering key insights into how lakes respond to changing hydrology.

Project REACTION: Unraveling how microbial mats shape trophic and community complexity in shallow saline lakes

Paloma Alcorlo[1]*, Miguel Angel Fernández[1], Salvador Molla[1], Máximo Florín[2], Rodríguez, J.[1], Cristina Cid[3], Graciela de Diego[3], and Ana López-Archilla[1]

[1]Departamento de Ecología Universidad Autónoma de Madrid. [2]E.T.S. Ingeniería de Caminos, Canales y Puertos UCLM, Ciudad Real. [3]Centro de Astrobiología (CAB-CSIC) e Instituto Nacional de Técnica Aeroespacial (INTA)

paloma.alcorlo@uam.es

REACTION is a comprehensive interdisciplinary project that aims to expand current knowledge of the ecological functioning of several alkaline and hypersaline shallow lakes and their potential adaptability to disturbances resulting from climate change by integrating molecular tools for DNA and RNA analysis with the characterization of food webs, measurements of net primary productivity and metabolic rates of the shallow lakes. The overarching hypothesis is that permanent systems exhibit stronger responses to increasing drought periods. In contrast, temporary systems show greater resilience in the key compartment that regulates community assembly through bottom-up control—microbial mats— as inferred from their functional diversity, whereas permanent systems display greater functional redundancy. Here we present the preliminary results from the spring 2025 field campaign for the three saline shallow lakes under study: the permanent magnesium-sulfate Salada de Chiprana (Zaragoza) and the Pétrola concentration pond (Albacete), and the temporary alkaline calcium-magnesium carbonate shallow lake of Caballo Alba (Segovia). The characterization of microbial mats has been carried out by means of metagenomic approaches. The structure of food webs has been determined through the analysis of stable isotopes ($\delta^{13}C$ and $\delta^{15}N$) in the different community components. In addition, in situ measurements of the net community production of planktonic and benthic microbial communities have been conducted. Ecosystem metabolic rates have been estimated using the diel oxygen method, continuously recording changes in dissolved oxygen concentration over at least 36-hour periods to obtain daily oxygen curves.

From contributory to collaborative: a new design for the ecological diagnosis of Mediterranean rivers with citizen science

Arnau Balot[1], Maria Soria[1]*, Pau Fortuño[2]

[1]BETA Technological Centre- University of Vic- Central University of Catalunya (BETA- UVIC- UCC), Carretera de Roda 70, 08500, Vic, Barcelona, Spain. [2]Ecological and Forestry Applications Research Centre (CREAF), Campus de Bellaterra (UAB) Edifici C, Cerdanyola del Vallès 08193, Spain..

maria.soria.extremera@uvic.cat

La gran mayoría de los proyectos de ciencia ciudadana contemplan una involucración limitada de los participantes, relegándolos a la recopilación de datos (modelo contributivo), una limitación que restringe el potencial transformador de los proyectos tanto a nivel académico como social. Este estudio documenta la transición del proyecto RiuNet —una herramienta para diagnosticar el estado ecológico de los ríos mediterráneos— de un enfoque top-down hacia un marco colaborativo. Mediante la implicación de entidades de educación en el tiempo libre en Cataluña —consideradas espacios pedagógicos singulares fuera de la educación formal— en un proceso participativo de co-diseño, rediseñamos la aplicación móvil del proyecto con el objetivo de mejorar su usabilidad, su capacidad de implicar a los participantes y su impacto educativo. La metodología incluyó dos fases participativas en línea: una actividad formativa basada en diagnósticos virtuales y un taller colaborativo. Estas sesiones permitieron a los actores identificar barreras, como los tecnicismos, la complejidad de algunos procesos y la falta de apoyo visual. Clasificamos las mejoras necesarias en cinco ámbitos estratégicos: (i) necesidades de apoyo y formación, (ii) accesibilidad visual y lingüística, (iii) feedback y reconocimiento mediante resúmenes pedagógicos, (iv) fomento de la participación mediante la adaptabilidad según la edad y (v) diseño user-friendly con elementos de gamificación incorporados. Este estudio demuestra cómo la incorporación del conocimiento específico de la comunidad y sus necesidades pedagógicas en la fase de diseño permite idear proyectos equilibrando el rigor científico con objetivos sociales y educativos. Al tener en cuenta las barreras institucionales y motivacionales del proyecto, el proceso colaborativo garantiza que las herramientas de monitoreo ambiental no solo sean técnicamente rigurosas, sino también sostenibles y aceptadas socialmente. En última instancia, este estudio de caso proporciona un modelo replicable para otras iniciativas que busquen empoderar a la ciudadanía y mejorar la gobernanza ambiental mediante un diseño inclusivo.

Ecological flow conditions as drivers of seasonal and vertical–horizontal distribution of reservoir microplastics

Catarina Guimarães[1], Sandra Nogueira[1,2], Mafalda Ferreira[3], Reza Jafarzadeh[3], Sara C. Antunes[1,2]*

[1]FCUP, Departamento de Biologia, Faculdade de Ciências, Universidade do Porto, Porto, Portugal. [2]CIMAR/CIIMAR, Centro Interdisciplinar de Investigação Marinha e Ambiental, Universidade do Porto, Terminal de Cruzeiros do Porto de Leixões, Matosinhos, Portugal. [3]FEUP, Faculdade de Engenharia, Universidade do Porto, Porto, Portugal

scantunes@fc.up.pt

Reservoirs are heavily modified water bodies created by dam construction, primarily for hydropower generation, water storage, and flood control. However, these ecosystems are increasingly exposed to diffuse pressures arising from human activities, which leach multiple stressors into the system, ultimately affecting water quality and ecological integrity. Microplastics (MPs) are emerging contaminants known to occur in freshwater environments, yet they are still not included in routine monitoring programs—an important gap considering that reservoirs often serve as sources for human water supply. This study aimed to assess the occurrence and spatial–temporal distribution of MPs in a Portuguese reservoir subject to different ecological flow regimes. Over the course of one year, and under distinct flow conditions, water samples were collected at multiple depths and longitudinal sections along 40 km of Carrapatelo Reservoir from the dam. Samples were subsequently analyzed and characterized to determine MP abundance and morphology. MP concentrations varied seasonally, with higher values in winter (58 MPs/L), under high flow conditions (630 m^3/s), and lower values in summer (27 MPs/L), associated with low flow conditions (192 m^3/s). Across all seasons, MP abundances were consistently higher at bottom than at surface samples, ranging from 39 MPs/L (Autumn) to 70 MPs/L (Winter) at bottom, and from 12 MPs/L (Summer) to 46 MPs/L (Winter) at the surface. Fibres were the dominant MP type in all seasons (> 83%). The predominant colours were blue, black, and grey, collectively accounting for more than 80% of MPs in each season. MPs in the 0.1-0.5 mm size range predominated in winter and autumn, whereas 1-2.5 mm MPs were more abundant in summer. Overall, this study reinforces the role of reservoirs as sinks for MPs and highlights that understanding seasonal dynamics and flow variations is crucial for elucidating their spatial distribution patterns, including depth-related accumulation. Acknowledgements: Project "2Qua - Water Quality and Quantity, the challenge for the present and future" (ref. 2023.17517.ICDT) is supported by national funds, through the Foundation for Science and Technology (FCT, Portugal), and European funds, through COMPETE2030 (COMPETE2030-FEDER-0691700). https://doi.org/10.54499/2023.17517.ICDT

Changes in the phytoplankton community of the El Val Reservoir: relationships with physicochemical parameters and toxicity

Aimee Valle-Pombrol*, David Elustondo Valencia, Yasser Morera Gómez

University of Navarra, Institute of Biodiversity and Environment BIOMA, Irunlarrea 1, 31008 Pamplona, Spain

avallepombr@alumni.unav.es

One of the main issues affecting water quality is the progressive increase in pollution and eutrophication of inland aquatic environments. A major consequence of such pollution is the proliferation of potentially toxic cyanobacteria (CyanoHABs), which pose risks to both humans and aquatic ecosystems. The El Val Reservoir, located within the Ebro River basin, provides irrigation services to the province of Tarazona, highlighting the importance of its continuous monitoring. A report by the Ebro River Basin Authority (Confederación Hidrográfica del Ebro) confirms that discharges from nearby towns, farms, and a fish farm have deteriorated the reservoir's water quality to an alert level. Our study is based on statistical analysis performed in R using one year of monitoring data. The results describe the temporal behavior of cyanobacterial CyanoHABs, as well as the overall composition and abundance of phytoplankton communities. The correlation between these biotic components and physicochemical parameters provides insights into the water quality status throughout the year.

Reintroducción de una planta acuática en peligro crítico: *Hydrocharis morsus-ranae* en Doñana

Rocío Fernández-Zamudio[1]*, Miguel de Felipe[1], Dolores Cobo[2], de los Reyes, L.[2], María del Carmen Ramírez-Soto[1], Pablo García- Murillo[3], Carmen Díaz-Paniagua[1]

[1]Estación Biológica de Doñana, Consejo Superior de Investigaciones Científicas, Spain. [2]Espacio Natural Doñana, Spain. [3]Departamento de Biología Vegetal y Ecología, Universidad de Sevilla, Spain

rzamudio@ebd.csic.es

Hydrocharis morsus-ranae es un hidrófito propio de medios acuáticos permanentes, catalogado “en peligro de extinción” en el Catálogo Español de Especies Amenazadas. La población del Parque Nacional de Doñana, una de las últimas que quedaban en España, dejó de observarse en condiciones naturales en 2019. En 2024, iniciamos un programa de reintroducción a partir de propágulos obtenidos de la población original y mantenidos ex situ en el Laboratorio de Propagación Vegetal de la Junta de Andalucía. Para ello, se introdujeron turiones en 36 puntos de aguas permanentes: 6 lagunas naturales y 30 profundizadas artificialmente para que mantengan agua todo el año. En el primer año de seguimiento, se observó desarrollo y crecimiento de las plantas en el 61% de las localidades, que son las que además mantuvieron agua hasta el siguiente ciclo hidrológico. De éstas, un 45% desarrollaron flores y frutos. Las causas de fracaso en la introducción fueron la desecación de los cuerpos de agua en verano y la depredación por herbívoros. En 2025, se han monitorizado 26 puntos, de los que en 5 de ellos se habían vuelto a introducir turiones. La planta volvió a desarrollarse en el 56% de los puntos, mostrando un gran vigor, con producción de flores y frutos e incluso manteniéndose hasta el invierno en el 50% de las localidades. El éxito de las poblaciones de *H. morsus-ranae* reintroducidas requiere garantizar la existencia de ambientes con aguas permanentes. Esto depende de una correcta gestión de las extracciones del acuífero, del cual dependen sus hábitats. Además, la alta herbivoría observada hace plantear la necesidad, dentro del Plan de Reintroducción en marcha, de tomar medidas que salvaguarden a los ejemplares de depredación por herbívoros. Por último, también es conveniente mantener ex situ la especie para poder asegurar futuros reforzamientos de las poblaciones.

From wetland to landscape: drivers of body condition and relative abundance in the European Pond Turtle *Emys orbicularis*

Santiago Poch[1,2]*, Daniel Escoriza[1], Dani Boix[1]

[1]GRECO, Institute of Aquatic Ecology, University of Girona, Girona, Spain. [2]Fundació Emys, Riudarenes, Spain

santipoch97@gmail.com

Semi-aquatic species rely on terrestrial and aquatic ecosystems to complete their life cycle, carrying out crucial activities such as nesting, reproduction, dispersal, or feeding across the two environments. However, there is a lack of understanding of how multi habitat features shape population status, which may limit the impact of conservation measures. This study developed a multi-year (2022-2025) capture-recapture program to investigate the effect of habitat and meteorological drivers of body condition (Scaled Mass Index) and relative abundance (catch- per-unit-effort, CPUE) across 32 sites in mainland and insular habitats and explored the differences among them. Bayesian regression models indicated that body condition is driven by turtle sex and local habitat factors, whereas relative abundance is driven by large scale variables. Invasive species also played an important role in E. *orbicularis* status, with *G. holbrooki* having a negative association with body condition and *P. clarkii* having a mixed effect, positive in body condition and negative for relative abundance. There were contrasting differences between island and mainland habitats, as meteorology was the main driver of relative abundance in the mainland, whereas habitat properties had a more prominent role on the island. Moreover, temporary habitats had a positive effect on body condition on the island, but the effect was negative on the mainland. This study highlights the significance of multi-type habitat properties on *E. orbicularis* status and emphasizes the profound differences between insular and mainland habitat relationships. To preserve *E. orbicularis* populations, it is crucial to focus on both terrestrial and aquatic habitats, and alien species may have a noticeable role in driving their conservation status. Together, these factors should be considered to develop effective management strategies, and to achieve a recovery of the commonly declining populations of this species.

Gestión del agua y biodiversidad acuática: especies autóctonas y exóticas en sistemas del Baix Ter

Valentina Amore*, Dani Boix, Jordi Sala, Stephanie Gascón, Anna Menció, Xavier D.Quintana

Universidad de Girona, 17190, Girona, España

valentina.amore@udg.edu

Los paisajes rurales mediterráneos y sus urbanizaciones próximas están acelerando la sustitución de comunidades acuáticas autóctonas por especies exóticas. En la llanura aluvial del Baix Ter (Girona), el uso agrícola del territorio, la red de canales de riego y la urbanización dispersa han modificado la calidad del agua y la dinámica hidrológica de canales y lagunas costeras. En el marco de los proyectos AquiPondSys (PID2023-147186OB-100), en el que se estudian sistemas acuífero-laguna, y HidroNet Baix Ter (HBT; 2022–2025), que propone Soluciones Basadas en la Naturaleza para hacer frente a las inundaciones, se evaluó el efecto de la antropización sobre la diversidad biológica de las comunidades acuáticas. La hipótesis planteada fue que el deterioro asociado a la presión antrópica favorece el establecimiento de especies exóticas en detrimento de las autóctonas. Durante dos ciclos anuales se desarrolló un muestreo en canales de drenaje y de riego próximos a núcleos urbanos y áreas agrícolas de los municipios de Ullà, Gualta y Torroella de Montgrí y en la laguna del Ter Vell, laguna costera receptora de las escorrentías de la zona. Se analizaron nutrientes del agua, junto con la composición de macroinvertebrados y microcrustáceos. Los resultados muestran un patrón consistente: los puntos con mayor influencia urbana y agrícola presentan mayor proporción de especies exóticas, mientras que los tramos menos intervenidos mantienen comunidades dominadas por taxones autóctonos. En conjunto, estos resultados sugieren que es importante mantener los flujos hidrológicos lo más naturales posibles para la protección de las especies autóctonas asociadas a los cursos de agua secundarios en los sistemas deltaicos y para reforzar la resiliencia ecológica del ecosistema acuático.

Biodiversidad acuática en lagos urbanos de la ciudad de Valencia

Maria Anton-Pardo[1]*, Laura Beatriz Gomes Mendonça[2], Yasmin Rodrigues de Souza[3], Carolina Lafuente Catalá[1], Daniel Grillo-Avila[1]

[1]Instituto Cavanilles de biodiversidad y Biología Evolutiva, Universitat de València, Catedrático Beltrán 2, 46980 Paterna, Valencia, España. [2]Universidade Federal de Goiás, Goiânia, Brasil. [3]Universidade Estadual de Maringá, Maringá, Brasil

anparma@uv.es

Most urban green areas have aquatic habitats which can hold a high diversity of flora and fauna, representing refuges or natural islands for species in the urban environment. These areas can suffer relevant and specific anthropic impacts, such as pollutants related to human activities -pharmaceuticals, plastics-, eutrophication, a highly artificialized basin, or their low connection with other water bodies -isolation- . In this work, six aquatic habitats from urban areas from Valencia have been sampled. The objective was to test the response of aquatic organisms to the environment in these areas, through a multi-taxon approach: phytoplankton, zooplankton and macroinvertebrates. Environmental variables as well as variables related to the land use around the water bodies were measured, and their effect on community composition and structure was tested. The results show that communities are dominated by cosmopolitan species and tolerant to eutrophication (cyanobacteria, rotifers, copepod juveniles), with low to moderate levels of diversity. The impact of land use surrounding the water bodies was not consistent among taxa, showing contrasting results. Beta diversity among water bodies was high, so even if the specific characteristics of the urban environment represent a strong environmental filter for the species in these habitats, other factors related with the connectivity or local management of these sites can be relevant for community composition and diversity.

Bathymetry of the main lakes of Byers and Hurd peninsulas (Livingston Island, South Shetland Islands, Antarctica)

Ignacio Granados[1]*, Manuel Toro[2], Carlos Manso[3], Antonio Camacho[4], Samuel Cirés[3], David Velázquez[3]

[1]Centro de Investigación, Seguimiento y Evaluación, Parque Nacional de la Sierra de Guadarrama, 28740 Rascafría, Spain. [2]Área de Medio Ambiente Hídrico, Centro de Estudios Hidrográficos (CEDEX), 28005 Madrid, Spain. [3]Departamento de Biología, Universidad Autónoma de Madrid, 28049 Madrid, Spain. [4]Instituto Cavanilles de Biodiversidad y Biología Evolutiva (ICBIBE), Universidad de Valencia, 46980, Paterna, Spain

ignacio.granados@pnsg.es

Livingston Island is mostly covered by glacier ice, but the summer ice-free areas display a high abundance of polar lakes that thaw during summer, particularly on the Byers Peninsula (Antarctic Specially Protected Area No. 126), in the western part of the island. With more than 60 lakes, it represents the most important limnological site in the Antarctic Peninsula region. Hurd Peninsula, in the south-central part of the island, hosts only 3 lakes but one of them supplies the Spanish Antarctic Station Juan Carlos I. Despite their ecological importance and the fact that they have been the subject of numerous studies, no detailed morphometric analysis or bathymetric maps of the main lakes have been made available to date. Therefore, the objective of this study was to carry out bathymetric surveys of the main lakes on Byers and Hurd peninsulas on Livingston Island and to characterize their main morphometric parameters. Depth measurements were obtained using an echo sounder with an integrated GPS mounted on a remote-controlled survey boat, and these data were used to generate a 3D model of each lake. Bathymetric maps were built for 10 lakes on Byers Peninsula and 3 on Hurd Peninsula. These lakes are located within glacially over-deepened basins, and two of them are in contact with glacier ice. The studied lakes range in area from 3,600 to 69,400 m^2 and have maximum depths between 2.4 and 11.1 m. These bathymetric maps will provide a key basis for future geomorphological, paleolimnological, and sedimentological studies, while the morphometric parameters will be useful for studies quantifying ecological processes at the catchment or lake scale.

Limnología de los ríos del archipiélago de Kerguelen (Índico sur)

June Montero[1]*, Aitor Labandibar[1], Arturo Elosegi[1], Sylvie Muratorio[2], Gaëlle Brahy[2], Jacques Labonne[2], Maite Arroita[1]

[1]Departamento de Biologia Vegetal y Ecología, University of the Basque Country EHU, Leioa, Spain. [2]ECOBIOP, UMR INRAE-UPPA, Saint-Pée-sur-Nivelle, France

jmontero022@ikasle.ehu.eus

El archipiélago subantártico de Kerguelen, integrado en las Tierras Australes y Antárticas Francesas, constituye uno de los sistemas insulares más remotos del planeta, lo que ha modelado de manera determinante su biogeografía. Las particulares condiciones climáticas y su prolongado aislamiento han dado lugar a una biodiversidad reducida pero singular en un entorno desarbolado con una diversidad de paisajes, desde casquetes glaciares y extensas morrenas hasta zonas llanas turbosas. Los ríos de la zona se dividen en dos conjuntos: los que nacen del deshielo de los glaciares, y los que carecen de influencia glaciar. Aunque originalmente los ríos de Kerguelen carecían de peces, en la década de 1950 el gobierno francés ensayó la introducción de hasta 8 especies de salmónidos, entre los cuales la trucha común se ha adaptado particularmente bien. De esta forma, Kerguelen se ha convertido en un laboratorio natural para analizar la evolución de una especie invasora y sus efectos sobre el ecosistema. Aunque las poblaciones de salmónidos han sido objeto de numerosos estudios, hasta la fecha apenas hay trabajos sobre la biodiversidad y el funcionamiento de los ecosistemas fluviales de este archipiélago. En el presente trabajo hemos caracterizado la calidad del agua, analizado la biomasa de biofilm e invertebrados y determinado el metabolismo fluvial y la capacidad de retención de nutrientes. Además, se ha evaluado el posible efecto de los peces alóctonos en estos sistemas. Los resultados preliminares muestran una diversidad de invertebrados baja y aguas pobres en nutrientes, aunque la biomasa de biofilm es elevada como consecuencia de la ausencia de vegetación de ribera y de la no existencia de invertebrados raspadores. Hasta el momento, los datos no evidencian un efecto significativo de los peces sobre los sistemas lóticos estudiados.

A standardized simple method for the production of realistic microplastics for aquatic ecotoxicity testing

Pedro A. Costa[1,2]*, Laura Rodriguez-Lorenzo[3], Begoña Espiña[3], Justyna Wolinska[4], Lúcia Guilhermino[5,6], Bruno B. Castro[1,2]

[1]CBMA - Centre of Molecular and Environmental Biology / ARNET - Aquatic Research Network , University of Minho, 4710- 057, Braga, Portugal. [2]IB-S - Institute of Science and Innovation for Bio-Sustainability, University of Minho, 4710-057, Braga, Portugal. [3]INL - International Iberian Nanotechnology Laboratory, Av. Mestre Jose Veiga s/n, 4715-330 Braga, Portugal. [4]Leibniz Institute of Freshwater Ecology and Inland Fisheries, Department of Evolutionary and Integrative Ecology, 12587 Berlin, Germany. [5]Institute of Biology, Freie Universität Berlin, Department of Biology, Chemistry, Pharmacy, 14195 Berlin, Germany. [6]ICBAS – School of Medicine and Biomedical Sciences of Abel Salazar of the University of Porto, Department of Population Studies, Laboratory of Ecotoxicology and Ecology (ECOTOX), Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal. [7]CIIMAR – Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Research Group of Aquatic Ecotoxicology and One Health, Matosinhos, Portugal

id11151@alunos.uminho.pt

Plastic pollution has become a major focus in ecotoxicology in recent years. Approximately 109 million tonnes of plastics are estimated to accumulate in rivers and lakes, constituting 78% of all plastic in aquatic environments. Over time, plastics degrade into micro- and nanoplastics, whose ecological effects remain poorly understood, despite the recent boost in research in this area. Gaps remain partially due to the limited range of commercially available polymer test materials, both in polymer composition and morphology. Most experimental studies have focused on polystyrene spheres, despite the most prevalent polymers in the aquatic environment are polypropylene and polyethylene. Moreover, microplastics found in the environment are predominantly found as irregular particles (fibers and fragments), which are three times more frequent than spheres. In this study, we developed a simple and cost-effective method to produce irregular microparticles from pellets of homopolymers commonly found in freshwater ecosystems. Briefly, plastics were fragmented using an industrial blender using a standardized approach that does not alter polymer identity, separated through sequential sieving, and quantified by fluorescence microscopy. Although previous studies have successfully generated plastic particles for laboratorial studies, those methods often require expensive equipment or involve reagents that are potentially toxic or that may compromise polymer structure. This method to produce polypropylene and low-density polyethylene microparticles in the laboratory warranted minimal contamination and preserved chemical structure of the source material. Specifically, we obtained three suspensions of plastic microparticles (10–50 µm, 50–100 µm, and 100–125 µm) in several successful batches, whose size distribution and particle concentration were estimated by fluorescence microscopy, and chemical composition confirmed by Raman spectroscopy. This accessible and reproducible protocol addresses a critical gap in ecotoxicology by offering a standardized approach to produce essential polymer test micromaterials without the need for costly equipment, thereby facilitating future ecotoxicity assessments.

Metformin & Climate Change Stressors: *Daphnia magna* insights

Marta Rojais[1,2,3], Sara Rodrigues[4,5], Sara C. Antunes[2,3]

[1]School of Medicine and Biomedical Sciences (ICBAS), University of Porto, Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal. [2]Interdisciplinary Centre of Marine and Environmental Research (CIMAR/CIIMAR), University of Porto,Terminal de Cruzeiros do Porto de Leixões, Avenida General Norton de Matos S/N, 4550-208 Matosinhos, Portugal. [3]Biology Department, Faculty of Sciences, University of Porto, Rua do Campo Alegre S/N, 4169-007 Porto, Portugal. [4]Centre of Molecular and Environmental Biology (CBMA), University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal. [5]Biology Department, School of Sciences, University of Minho, Campus de Gualtar 4710-057 Braga, Portugal

up202106949@up.pt

Metformin (MET) is a widely prescribed antidiabetic drug for type-II diabetes mellitus, whose widespread use, combined with incomplete removal capacity in conventional wastewater treatment plants, leads to continuous discharge into surface waters, threatening aquatic biota and compromising ecosystem stability. Concomitantly, freshwater ecosystems face intensifying climate-change-driven thermal stress (e.g., warming and extreme cold events), which can alter contaminant toxicity and complicate ecological risk predictions. This study evaluated how thermal stress modulates the long-term ecotoxicological effects of metformin in *Daphnia magna*. *D. magna* reproduction tests (0 to 100 µg MET/L; 21 days; OECD 211 guidelines) were conducted at: 20 °C (standard), 24 °C (warming scenario; + 4 °C increase projected by the IPCC until 2100), and 15 °C (cold-wave scenario; - 5 °C decrease based on WMO cold wave duration index). Biomarkers related to oxidative stress, detoxification, neurotoxicity, energetic reserves, and genotoxicity were quantified. *D. magna* reproductive traits were strongly modulated by temperature. At standard temperature (20 °C), MET exposure stimulated concentration-dependent responses in key reproductive parameters, including fertility, reproductive output, and first brood fecundity. Considering the warming scenario (24 °C), significant interactions between MET and temperature were observed for fecundity, reproductive output, and first brood fecundity endpoints. Furthermore, *D. magna* exhibited enhanced reproductive traits, including earlier maturation, increased offspring numbers and fecundity, higher reproductive output, and greater population growth. Preliminary biomarker patterns suggest that the physiological responses triggered by MET are modulated by temperature. Thermal stress appears to amplify metabolic turnover, potentially enhancing both MET uptake and life-history plasticity in *D. magna*. The integration of life-history traits with mechanistic biomarkers provides a multilevel perspective on MET toxicity under climate-driven thermal stress. These findings underscore the complexity of multi-stressor interactions in freshwater ecosystems and emphasize the need to incorporate climate-related stressors into ecological risk assessment frameworks.

Análisis del impacto del ciprínido invasor *Alburnus alburnus* en redes tróficas de ríos de la cuenca del Guadalquivir (SO, España)

Alvaro Coutín[1]*, Paloma Alcorlo[1], Felipe Morcillo[2], Anabel Perdices[3]

[1]Departamento de Ecología Universidad Autónoma de Madrid. [2]Departamento de Biodiversidad, Ecología y Evolución. Facultad de Ciencias Biológicas. Universidad Complutense de Madrid. [3]Departamento de Biodiversidad y Biología Evolutiva. Museo Nacional de Ciencias Naturales, MNCN-CSIC

alvaro.coutin@estudiante.uam.es

El presente trabajo se enmarca dentro del proyecto HYBRIDIAS (PID2023-147743NB-I00), cuyo objetivo principal es evaluar la pérdida de biodiversidad producida por el alburno (*Alburnus alburnus*), especie invasora de pez de agua dulce, en las especies simpátricas nativas de cypriniformes *Anaecypris hispanica*, *Iberochondrostoma lemmingii*, *Pseudochondrostoma willkommii* y *Squalius alburnoides*. Este impacto se analizará mediante los procesos de hibridación entre las especies nativas e invasoras, situación favorecida por la intensificación de los periodos secos debido al cambio climático. Para ello, se utilizará un enfoque multidisciplinar combinando análisis morfológicos, moleculares y estudios de dieta de las especies parentales y de sus híbridos con el alburno, en diferentes afluentes de la cuenca del río Guadalquivir. En concreto, se evaluará el impacto del alburno y sus híbridos sobre las comunidades de macroinvertebrados bentónicos y productores primarios mediante el análisis de las redes tróficas en condiciones de bajo caudal o cuando los ríos quedan fragmentados en charcas desconectadas. Las redes tróficas se caracterizarán a través del análisis de isótopos estables ($\delta^{13}C$ y $\delta^{15}N$) en los distintos componentes de la comunidad y se analizarán con el paquete SIBER en R. La superposición de nichos de las especies de los parentales y sus híbridos se analizará mediante análisis bayesiano de elipses (SEAB). La hipótesis de partida que se plantea es que la presencia del alburno y sus híbridos supondrá un cambio en la estructura de la red trófica, efectos que se verán reforzados por el efecto del aislamiento estival de las localidades estudiadas.

Does the invasion of riparian deciduous forests by *Acacia dealbata* alter nutrient inputs to streams via leaf litterfall?

Catarina Caldeireiro[1]*, Albano Figueiredo[2], Verónica Ferreira[1]

[1]MARE – Marine and Environmental Sciences Centre, ARNET – Aquatic Research Network, Department of Life Sciences, University of Coimbra, 3000-456 Coimbra, Portugal. [2]CEGOT – Centre of Studies in Geography and Spatial Planning, Department of Geography and Tourism, University of Coimbra, 3004-530 Coimbra, Portugal

catarinadjcaldeireiro@gmail.com

Biological invasions are a major global threat, affecting ecosystem functioning. Riparian forests are especially vulnerable to invasion due to their position at the land-water interface. Riparian forests and streams are interconnected and function as a meta-ecosystem in which litterfall is a primary energy source for aquatic food webs. Australian acacias are among the most aggressive invasive species worldwide. *Acacia dealbata*, in particular, is an evergreen nitrogen-fixing species that differs from native tree species of temperate deciduous forests in Mediterranean-climate regions, where it is a main invader. Here, we addressed whether the invasion of native riparian forests by *A. dealbata* alters nutrient inputs to streams via leaf litterfall. For that, we collected leaf litterfall samples monthly, over one year, in three native and three invaded riparian forests, in central Portugal, to assess leaf litter mass and nutrient concentrations at monthly, seasonal, and annual scales. Leaf litterfall peaked in autumn/winter in native riparian forests and in spring/summer in invaded ones, being higher in native than invaded forests in autumn/winter and lower in spring/summer. Despite these differences, the annual leaf litter production was similar between native and invaded riparian forests (304 vs 267 g/m^2). Phosphorus leaf litter amount peaked in autumn/winter in native riparian forests, while it was constant throughout the year in invaded ones, being higher in native riparian forests than invaded ones in autumn/winter only. Annual leaf litter phosphorus amount was higher in native than invaded forests (1142 vs 330 mg/m^2). Nutrient contributions to streams via leaf litterfall in native riparian forests were mostly done by *Castanea sativa*, *Salix* spp., and *Quercus robur*, while in invaded riparian forests were mostly done by *A. dealbata*. Invasion of riparian forests by *A. dealbata* changes dynamics of leaf litter production and nutrient inputs to streams, which can impact aquatic food webs and ecosystem functioning.

Tourism pressure, environmental integrity and quality in sensitive systems: insights from Madeira Island

Giorgia Michela Ricci[1,2]*, Aracelis Rajnauth[3,4], Diane Esson[1,2], Thais Coppen[5,6,7], Patrício Ramalhosa[1,2], João Canning-Clode[1,2], Inês Órfão[1,2]

[1]MARE (Marine and Environmental Sciences Centre) / ARNET (Aquatic Research Network), ARDITI (Agência Regional para o Desenvolvimento da Investigação Tecnologia e Inovação), Funchal, Madeira, Portugal. [2]Faculty of Life Sciences, University of Madeira, Funchal, Madeira, Portugal. [3]Madeira Oceanic Observatory, ARDITI, Funchal, Portugal. [4]Earth Science Institute, Faculty of Science, University of Porto, Porto, Portugal. [5]Insect collection Madeira University, Funchal, Madeira, Portugal. [6]Center of Investigation in Biodiversity and Genetic Resources, University of Porto, Porto, Portugal. [7]Department of Biology, Faculty of Science, University of Porto, Porto, Portugal

riccigiorgiam@gmail.com

Tourism is a rapidly expanding global industry that is increasingly dependent on nature-based experiences including trekking, hiking, and canyoning. A global concern is that tourism can exceed ecological carrying capacity, particularly in sensitive environments such as oceanic islands. This study examined tourism pressure on Madeira, a small and environmentally vulnerable island of the Macaronesia region, where tourism represents a major economic sector, especially considering levadas. Levadas are human-made open irrigation channels that transport freshwater from Madeira's high-altitudes to the coastal areas, providing essential water supply and supporting inland ecosystems. Tourism pressure on these systems were evaluated along six levada trails with varying levels of visitor intensity and length. We quantified litter abundance and composition, assessed pedestrian trail integrity and safety, and analyzed key water quality parameters. Litter abundance and the number of accumulation points increased markedly with visitor intensity and trail length, with used paper tissues being the most common items. Conversely, trail integrity and path safety were generally better maintained on heavily visited levadas, while less-frequented trails exhibited poorer conditions. Water quality showed limited variation among trails. These findings are crucial for developing proactive management strategies to safeguard ecological integrity while supporting sustainable nature-based tourism, including enhancing visitor awareness and promoting responsible behavior.

Índice de autores · Author Index

Page numbers refer to the abstract book pdf (AIL2026 Bilbao).

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

Y

Z