SIBIC 2024

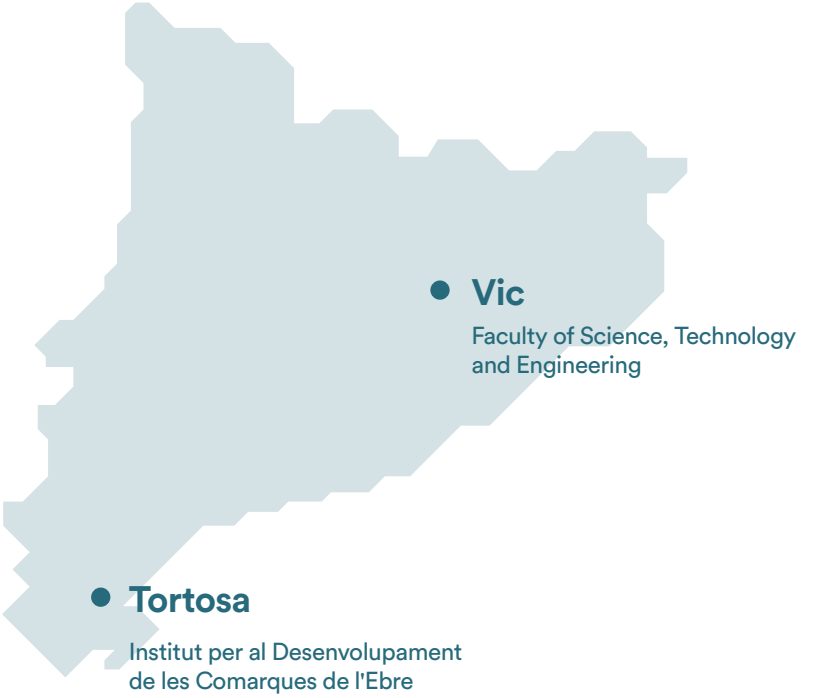
X Iberian Congress of Ichthyology

The Iberian Society of Ichthyology (SIBIC) and the University of Vic – Central University of Catalonia organize the X Iberian Congress of Ichthyology, 'Fishes for Future', in Catalonia on June 18-21 of 2024: on June 18, the SIBIC 2024 & Life MigratoEbre project joint session will take place in Tortosa (Institut per al Desenvolupament de les Comarques de l'Ebre), on June 19-21, in Vic (Faculty of Science, Technology and Engineering).

SIBIC congresses are celebrated every two years to address scientific and management challenges related to different aspects of Ichthyology. This edition, among other novelties, will include topics such as freshwater and marine fish, and aquaculture. It will be open to researchers from other countries.

We like to see you in Tortosa and/or Vic in June 2024!

SIBIC Organising Committee



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	ACTIVITIES IN TORTOSA		ACTIVITIES IN VIC		
	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
09:00 h		Opening	Registration	Plenary Session: Ignacio Dodario	Plenary Session: Clara Amorim
09:30 h		Life Miagratoebre Sessions	Opening		
10:00 h			Plenary Session: Teresa Ferreria	Scientific Sessions BI and MC	Scientific Sessions EC and SY
10:30 h	Course: RFID for fishing and wildlife tracking				
11:00 h		Coffee Break	Coffee Break (Posters FF, MF and BW)	Coffee Break (Posters EC)	Coffee Break (Posters MC)
11:30 h		Life Migratoebre Sessions	Scientific Sessions FF, BI and MF	Scientific Sessions BI and TO	Scientific Sessions EC and SY
12:00 h	Course: Building a PIT TAG monitoring station				
12:30 h					
13:00 h		Lunch	Lunch	Lunch	Lunch
13:30 h					
14:00 h		Departure visit of Xerta weir IRTA's Aquaculture Center			
14:30 h	Course: PIT TAG antennas		Plenary Session: Emili Garcia-Berthou	Plenary Session: Raphaël Lagarde	Plenary Session: Laia Ribas
15:00 h					
15:30 h			Scientific Sessions BI and MC	Scientific Sessions BW and TO	Scientific Sessions MF and MI
16:00 h	Interactive Workshop				
16:30 h					
17:00 h		Departure to Vic	Coffee Break (Posters BI)	Coffe Break	Coffee Break (Posters MI, SY, TO)
17:30 h			Courses and Project Networking	Picth and Coffee	Closing Cerimony
18:00 h					
18:30 h				SIBIC Assembly	
19:00 h					
19:30 h					

	ACTIVITIES IN TORTOSA		ACTIVITIES IN VIC		
	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
20:00 h	Icebreaker in Tortosa	Icebreaker in Vic	Cultural Activity	SIBIC Assembly	
20:30 h				Bus to Manlleu	
21:00 h				SIBIC 2024 Dinner at Ter River Museum (Manlleu)	
21:30 h					
22:00 h					
22:30 h					
23:00 h				Bus to Vic	

CODE	SESSION
FF	Fishes for future and global change
MF	Marine fisheries
BW	Fish behaviour and welfare
BI	Biological invasions and invasive species
EC	Ecology, life cycles and trophic structure
MC	Management and conservation of species and habitats
MI	Migration and connectivity
SY	Systematics, phylogeography and evolution
TO	Tools and methodologies in fish research

Posters will always be on display. But each Coffeee Break will be focussed on specific session (when authors are invited to stand in front of their poster).

Summary

How science supports management actions on diadromous fish

AUTHORS: Eric Rochard

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ABSTRACT CONTENT: Most European diadromous fish are under threat, constrained by numerous obstacles, poor water quality and overfishing. Their range has shrunk and, for most of them, climate change is an additional pressure. Management actions require varying degrees of scientific knowledge and know how to achieve their objectives. In Western Europe's highly anthropised river basins and coastal areas, diadromous fish must be managed in harmony with many other activities. This task is difficult and requires a high level of expertise. Numerous research teams in Europe are carrying out research into the ecology, physiology and conservation of diadromous fish, as well as the impacts they suffer and how to limit them. The working groups are a specific way of tackling different issues (e.g. TAC), some of which concern diadromous fish. In case of very specific or sensitive issues, a collective scientific assessment may be carried out. Researchers regularly responds to calls from various bodies to work on specific themes and issues. These calls can be broadly open or very specific (e.g. improve the ability to cross an obstacle), on a large scale (e.g. EU), or on a regional scale. In most cases, these calls are problem solving in nature. The expected work will provide new knowledge and management recommendations on an issue. The text of the call reflects the issues and themes considered important by the stakeholders who publish it. It depends on the state of knowledge (results of previous research and experience) and the specific expectations of stakeholders, but it is also influenced by position papers and columns in newspapers written by scientists. In some cases, there is no call for proposals; stakeholders wishing to support the management of diadromous fish receive and examine proposals made by scientists. Depending of the case, the proposal may be peer-reviewed or discussed only with the stakeholder's research and development staff. In this case, the expected benefits for managers are at the heart of the proposal. The results are first published in scientific journals, sometimes with a few suggestions for management. In the last five years, more than 200 papers concerning diadromous species have been published worldwide. More than half of them present results that could be helpful for managers. However, few managers read these journals and scientists have to find other ways of explaining the results and management recommendations to stakeholders. The reports provided to funders are not very scientifically valuable documents, but they can be used as a mean of communicating with managers. They can be presented in symposiums dedicated to region, issues, and technical solutions open to stakeholders. We note that when NGOs or environmental agencies are involved in research work, this makes it easier for managers to take the results into account.

Sturgeon species recovery in Western Europe: focus on *Acipenser sturio* & *A. oxyrinchus*

Authors: M.L. Acolas

Institution: French National Research Institute for Agriculture

Contact:

Abstract content: Sturgeons are endangered species worldwide. They are long-lived species with late maturity, and several species are anadromous, i.e. reproducing in the river and growing at sea. In Western Europe, recovery programs are ongoing for two sturgeon species. One program concerns the European sturgeon *Acipenser sturio*, which was present from the Black Sea to the North Sea, including the Mediterranean, in the 1850s. However, the number of populations decreased drastically from the early 1900s, with the last natural reproduction occurring in the Gironde-Garonne-Dordogne system (France) in 1994. *In-situ* conservation measures were implemented accordingly but the species marine distribution was considerably reduced with a current distribution from the Bay of Biscay to the North Sea. Thanks to the rescue of wild individuals in the 1990s, an *ex-situ* stock was constituted in France succeeding in the preservation of the indigenous species and the remaining genetic diversity for stocking practice purposes. Since then, several stocking events occurred in the Gironde-Garonne-Dordogne system in France and the Elbe River (Germany) with more than 1.8 M individuals released. The second program concerns the Atlantic sturgeon *A. oxyrinchus*, which is currently present in North America, and which was present in Europe mainly in the Baltic Sea in the last centuries. Functional populations of this species completely disappeared from Europe since 1960s. Recovery efforts rely on translocations of *A. oxyrinchus* eggs originated from Canada that were used to constitute *ex-situ* stocks with the objective of releases in rivers along the Baltic Sea since 2006. The countries involved in the recovery plan are Germany, Poland, Lithuania, Latvia, Estonia, Russia, and Sweden. Odra, Vistula and Nemunas are the main rivers chosen for stocking, with more than 4.5 M individuals released. For both species, experimental releases also occurs in other catchments, along their native range, to assess their recovery potential and to provide food for thought on whether or not increasing stocking spots.

The presentation will focus on some lessons learned from those recovery actions and current issues.

Shads (*Alosa alosa* & *Alosa fallax*) in the Atlantic: status and trends

Authors: Fernando Cobo

Institution: Department of Zoology, Genetics, and Physical Anthropology. Faculty of Biology, University of Santiago de Compostela

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Abstract content: Limited knowledge exist regarding the coastal and continental distribution and migration dynamics of the shad species *Alosa fallax* (Lacépède, 1803) and allis shad *Alosa alosa* (Linnaeus, 1758). Historically, the distribution of *Alosa* species covered the eastern Atlantic from Norway to Morocco and the Western Mediterranean Sea. However, since the mid-20th century, a clear contraction of their natural distribution range occurred, leading to the current distribution restricted to the coast of France, Spain and Portugal in the Atlantic. The study of data obtained from freshwater field sampling campaigns and records of bycatch and historical marine landings has enhanced our understanding of this subject. Analysis of marine catch records indicates that both species are present at sea throughout the year, with captures peaking in January. From January onwards, catches progressively decline until they nearly exist during the summer, especially for *A. fallax*, suggesting the initiation of upstream migration for the majority of the population at this time. In rivers, both species can be captured in March, but data suggests that *A. alosa* starts the spawning migration one month earlier, as peak levels of captures occur in March-April for *A. alosa*, and in April-May for *A. fallax*. An increase in captures from September to January in both marine and rivers environments indicates a progressive approach of shad shoals to the coast. The delay between declining catches along the coast and increasing catches in the river may be attributed to a longer stay near the river mouth or within the estuarine area waiting for optimal conditions for the upstream migration. Catches showed cyclically variations and both species exhibit a coastal distribution near the rivers where they spawn. Continuous catches of shads in the marine environment suggest a certain stability of their populations despite considerable interannual variations. Finally, genetic structure between populations was lower for the nearly semelparous species *A. alosa* that disperse longer distances compared to the iteroparous species, *A. fallax*.

Fishes in a changing world

Authors: Maria Teresa Ferreira

Institution: Forest Research Centre, Associate Laboratory TERRA, School of Agriculture, University of Lisbon

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Abstract content: Rivers and other freshwater ecosystems are subject worldwide to unprecedent and intense pressures, as they are the backbone of all human activities and a finite resource. The scale of these pressures reached new levels of concern as climate changes progresses and human societies increase their demands. Fish among all species in freshwater environments, have responded to pressures by individual and community changes, and presently became one of the most threatened groups. Human pressures can act at different biological, time and space scales, determining how we can implement mitigation measures, and plan restoration. Both mitigation and restoration, are dependent on the proper identification of the basis of reference (where we consider the starting point) and the goals for the future (what we want to achieve in a suitable horizon). The former should be framed by ecological functioning rather than biotic scenarios that are impossible to achieve if those are not met, the latter depends on its actual feasibility for a certain time frame. However, both are profoundly intertangled with the so-called 5th dimension, the human societies with their needs, constrains and willingness to act. The process of evaluating changes and planning reactive actions to protect and restore rivers and their fish communities, is deeply linked to a continuous reliable monitoring (a clear knowledge of what is going on) for an accurate reading of biological responses, and the harmonization of such responses, making them clear to decision-makers and comparable across countries and legislative forum. There is a profound need to change from passive protection to active restoration, and from an ecosystem spare to a share perspective, focusing on ecological dynamics and processes as the basis for fish community conservation, including the connectivity at different dimensions, the flow of water and sediments, and the maintenance of water quality via pollutant control reaching the aquatic system in various ways. We will review pressures and fish community changes, and monitoring challenges, and the needs for restorative action in general and at European scale..

Fish invasions in Iberian inland waters: recent advances and future challenges

Authors: García-Berthou Emili

Institution: GRECO, Institute of Aquatic Ecology, University of Girona

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Abstract content: Invasive non-native species are a fundamental component of global change, with enormous environmental impacts and socioeconomic costs. They are particularly important in inland water ecosystems and Mediterranean climates, due to several reasons such as higher anthropogenic perturbation and often low richness but with sensitive endemics. I will provide an overview of our recent research on fish invasions in Iberian inland waters and the challenges that our academic community faces. Among other results, I will show that anthropogenic perturbation and particularly the hydrologic alteration caused by reservoirs and water abstraction tends to produce the decline of native fish species and favour invasive species, which are often limnophilic (i.e. do not prefer strong flows) and thermophilic. Although species such as mosquitofish (*Gambusia holbrooki*), one of the world's worst invasive species, and largemouth bass (*Micropterus salmoides*) tend to be more prevalent in the mainstem of hydrological-altered rivers, natural abiotic factors such as temperature and features of the upstream-downstream gradient seem to be more determinant. Accordingly, native and invasive species do not show marked differences in features such as critical swimming speed and tolerance to toxicants, suggesting that more pristine habitats are not immune to invasions and that further invasions will occur. Climate change will make things worse and invasive species in general will tend to benefit. Although our conceptual understanding of invasions has improved markedly, we notably lack knowledge of the ecological effects of non-native species, their interactions with native species, the role of abiotic factors in these interactions, and the role of diseases and pathogens. Management of invasions is far behind in the Iberian Peninsula and elsewhere, despite excellent communication projects such as Life Invasaqua, increased public awareness and administration attention, and many new tools. For instance, horizon scanning has emerged as a useful tool to identify future introductions but will not help to prevent them if current management resources and efficiency are not improved. I will try to identify why we are failing to prevent new introductions and the intentional, illegal spread of species such as the European catfish (*Silurus glanis*) to new river basins.

The Red book on Iberian fishes: past and future

Authors: Ignacio Doadrio

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Abstract content: The publication of the first freshwater fish distribution atlas in Spain, known as “The Atlas and Red Book of Freshwater Fishes of Spain” in 2001, marked a pivotal milestone in understanding and conserving the aquatic freshwater fauna of Spain. Its significance lies in several key aspects:

- Identification of critical areas: The atlas provided a comprehensive overview of the distribution of freshwater fish species in the Iberian Peninsula. This facilitated the identification of areas of high biodiversity and those in need of urgent conservation action.
- Awareness of threats: It revealed the challenges faced by aquatic organisms, such as invasive species, infrastructure development, and climate change. This raised awareness about the need to address these threats to protect aquatic biodiversity.
- Basis for management and conservation: The atlas offered a crucial database for the management and conservation of aquatic resources. It enabled decision-makers to design effective strategies for habitat protection and restoration.

Periodic monitoring of the atlas is essential for understanding how fish populations evolve and respond to emerging threats. In a context where invasive species, infrastructure development, and climate change are constantly changing, regular updates of the atlas allow:

- Assessment of trends: It enables the evaluation of how species distributions are changing over time and whether they are responding to identified threats.
- Adaptation of conservation strategies: It provides updated information to adapt and prioritize conservation strategies based on new threats and changes in fish populations.
- Guidance for scientific research: Data collected in periodic follow-ups serve as a valuable source of information for scientific research on the ecology and conservation of freshwater fish.

The future of freshwater fish distribution monitoring points towards increased frequency and the use of more advanced techniques, such as environmental DNA. These techniques are less costly and more efficient, allowing for more frequent data collection on a more detailed scale. This is crucial for addressing key questions about distribution and conservation models more accurately and promptly.

In summary, regular and updated monitoring of freshwater fish distribution using advanced tools is essential to ensure the effective protection of these organisms against growing threats.

Current research on the European eel (*Anguilla anguilla*) in French Mediterranean coastal lagoons

Authors: Raphaël Lagarde 1, 2

Institution: 1-Université de Perpignan Via Domitia, Centre de Formation et de Recherche sur les Environnements Méditerranéens, UMR 5110, F 66860, Perpignan, France; 2-CNRS, Centre de Formation et de Recherche sur les Environnements Méditerranéens, UMR 5110, F 66860, Perpignan, France

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Abstract content: Among the continental habitats occupied by European eel (*Anguilla anguilla*, referred to as eel hereafter), Mediterranean lagoons are of particular interest as the abundance of eels reported in these habitats is higher and their growth and silvering are faster than in most other habitats. In French Mediterranean, there are more than 80 lagoons for a combined area of approximately 85 000 ha making lagoons one of the most important continental habitats for eel in France. Despite the high number of eels in Mediterranean lagoons, a drastic decline in eel abundance in these habitats was documented as everywhere else in Europe. In lagoons, eel is also an emblematic cultural species mainly because it has been targeted by traditional fisheries for decades.In this presentation I review the scientific published literature concerning eel in French Mediterranean lagoons. This review is articulated along three main topics : 1-eel management and monitoring, 2-effect of anthropogenic impacts on eel and 3-eel life cycle and ecology. Globally, even if the scientific knowledge on eel in lagoons is not as developed as it is in other continental habitats such as rivers and estuaries, there have been many studies focusing on eel in French Mediterranean lagoons. However, these studies are not homogenous among topics. Most studies are focused on eel management and monitoring and on the effect of anthropogenic impact on eel with relatively less studies concerning eel ecology and life cycle. In particular, home range, habitat use and trophic ecology of eel in lagoon are generally undocumented. Moreover, most studies are focused on two workshop-sites (the Vaccarès and Bages-Sigean lagoons) and/or with a limited temporal scale (one year/season). Multi-sites and multi-years studies appear pivotal to better understand the variability of eels ecology and life cycle among French Mediterranean lagoons which represent a mosaic of diverse habitats. In term, this knowledge would guide the development of local management measures to improve the global management plans targeting the recovery of eel population.

The relevance of soniferous fishes for aquatic conservation

Authors: M. Clara P. Amorim

Institution: MARE-Marine and Environmental Sciences Centre / ARNET-Aquatic Research Network, Departamento de Biologia Animal, Faculdade de Ciências, Universidade de Lisboa, Portugal

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Abstract content: Many teleost fish species produce acoustic signals during social contexts, particularly during reproduction. While some species produce sounds that do not travel far, others produce sounds that can be detected with passive acoustics (PAM). Listening to fish sounds can therefore provide a cost-effective tool for conservation efforts. For example, PAM can be used to map fish spawning grounds and the temporal patterns of spawning activity. Tracking the interannual variability of breeding sounds could aid in fisheries management and provide insights into how environmental changes impact vocal fish populations. PAM is also relevant for the early detection and tracking the expansion of invasive vocal fish. Furthermore, fish sounds are increasingly being used to assess fish biodiversity, even in remote areas, thus providing a means to assess the health of ecosystems. Finally, similar to techniques used in bird conservation, the playback of fish sounds could potentially be employed to recover fish spawning grounds. In this presentation, I will share examples and findings to illustrate these ideas.

Epigenetic insight in the repro-immune interactions for shaping future fish phenotypes

Authors: Ribas, L.; van Gelderen, T.; and Joly, S.

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Abstract content: Over the last decade, promising data uncovering the underlying epigenetic mechanisms of fish traits have emerged. In fact, the epigenetic mechanisms are foreseen as sustainable solution to improve fish productivity by generating more resistant phenotypes in artificial environments. Here, experimental data from various environmental factors in which cultured fish are commonly subjected were scrutinized using cutting-edge methodologies (e.g., miRNA-and RNA-sequencing, Whole Genome Methylation Sequencing, WGMS, or Methylation Bisulfite Sequencing, MBS). To decode informative molecular markers serving as epirecorders of climate change and infection stresses, data on epigenetic mechanisms in European sea bass (*Dicentrarchus labrax*) and zebrafish (*Danio rerio*) were identified. For instance, transcriptomic data of European sea bass gonads 48 hours post-infection revealed a greater number of differentially expressed genes (DEGs) in testes than in ovaries. Similarly, a higher number of differentially expressed miRNAs was found in males than females in the gonads after bacterial infections. Temperature during the early stages of gonadal development in European sea bass and zebrafish induced alterations in the miRNome in adult animals, allowing to identification of miRNAs as heat-recorder markers. In conclusion, our findings underscore the significance of sexual dimorphism in epigenetic occurrences altering the final phenotype and highlighting the necessity of considering sex as a crucial factor in cultivated fish.

Communication and Awareness of Aquatic Invasive Alien Species in the Iberian Peninsula by LIFE INVASAQUA: Outcomes & Lessons Learned

Authors: Oliva-Paterna, Francisco J.1; Olivo del Amo, Rosa 1; López-Cañizares, Celia 1; Guillén-Beltrán, Antonio 1; Torralva, Mar 1; Anastácio, Pedro M. 2; Banha, Filipe 2; Brandão, Pedro 2; Barca, Sandra 3; Cobo, Fernando 3; Vieira-Lanero, Rufino 3; Casals, Frederic 4; Sánchez-González, Jorge R.4; Perdices, Anabel 5; Machordom, Annie 5; Miranda, Rafael 6; Oscoz, Javier 6; Numa, Catherine 7; Clavero-Sousa, Helena 7; Ribeiro, Filipe 8.

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Abstract content: The Spanish and Portuguese societies have a limited understanding of the threats posed by invasive alien species (IAS) in aquatic ecosystems. This gap of awareness about IAS problems hampers any proposed policy, contributing to missing an IAS management strategy. We present outcomes achieved by the LIFE INVASAQUA project that has run between 2018 and 2023 in the Iberian Peninsula. The main goal was to increase the Iberian public and stakeholders' awareness of aquatic IAS problems and to develop instruments that will improve an efficient management for aquatic IAS. INVASAQUA has to support the EU Reg. on IAS mainly by: (1) Development of governance key-instruments (strategic recommendations, updated IAS lists, Aquatic IAS Web-platforms, etc.); (2) Training and creating synergies between stakeholders (98 training events with the participation of 2,900 people); (3) Broadening stakeholder involvement (598 events with more than 480 involved institutions and 246,000 attended people); (4) Supporting communication and dissemination of information; (5) Promoting awareness raising on IAS problems (11,780 followers on social networks and 7,078 questionnaires evaluating perception regarding IAS which revealed an increase in awareness of IAS impacts. In sum, INVASAQUA has proven to be a good source of information on IAS, supporting enforcement and facilitating synergies between key stakeholders and general public. INVASAQUA has been funded by the LIFE Programme (LIFE17 GIE/ES/000515).

The introduction history of trout in high mountain lakes of the French Pyrenees: What about conservation?

Authors: Galop, Didier 1; Ventura, Marc 2

Institutions: 1-GEODE UMR 5602 CNRS, Université de Toulouse, 31058 Toulouse, France; 2-Integrative Freshwater Ecology Group, Centre for Advanced Studies of Blanes (CEAB-CSIC)

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Abstract content: High mountain lakes are naturally fishless, although many have had introductions of non-native fish species, predominantly trout. Predation on native fauna by introduced trout involves profound ecological changes, including the local eradication of amphibian and larger invertebrates, threatening their conservation. European high mountain lakes are a protected habitat by the EC-Habitats Directives, that also protects the amphibian, semiaquatic mammals and bats that are connected with aquatic lake fauna. A knowledge of fish introduction is a first step towards conservation planning. The objective of this study was to reconstruct the historical process of trout introduction in 628 high mountain lakes > 0.2 ha of the French Pyrenees. Nearly all the lakes were fishless at the beginning of the XIXth century, when there were only 10% of the lakes with fish, with the first citation going back to sXIV. From 1800 until 1950 the introduction rate increased by 14 lakes per decade reaching 30% of the lakes with fish, a similar situation than has been described from the southern Pyrenees (Miró & Ventura, 2013). From 1950 to 1975 there was the higher introduction rate when 227 lakes mostly in the National Park of the Pyrenees were introduced with the use of helicopter. After this date, the introduction rate continued at 18 lakes per decade until present, where there are 93% of the lakes with salmonids. Introduced species include *Salmo trutta* (present in 76 % of the lakes), *Salvelinus fontinalis* (33%), *Salvelinus alpinus* (8%), *Onchorhynchus mykiss* (6%) and *Salvelinus namaychus* (5%). The introduction purpose of fish in the lakes was for recreational fishing fueled from local fisheries. Fish stocking is active and maintained in most areas, although in the departments of Garonne, High Pyrenees and Oriental Pyrenees have the highest rate of stockings. The latter having a mean of more than 1000 individuals per ha of lake. Our results show that introduction policy in the French Pyrenees did not take into account conservation values. Taking into account the negative impact of salmonids on native fauna and the scale of the introductions that affect most high mountain lakes of the French Pyrenees, we recommend implementing urgent measures to incorporate conservation criteria into future management policies.

Fish community size spectrum analysis in different types of lentic ecosystems

Authors: de Meo, Ilaria 2; Encina, Lourdes 1; Orduna, Carlos 1,2; Rodríguez-Ruiz, Amadora 1; Cid-Quintero, Juan R. 2; Kahilainen, Kimmo 3; Hayden, Brian 4; Granado-Lorencio, Carlos 1.

Institutions: 1-Universidad de Sevilla, Spain; 2-EcoFishUS Research, Spain; 3-Lammi Biological Station, University of Helsinki, Finland; 4-Canadian Rivers Institute, University of New Brunswick, Canada.

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Abstract content: Size spectrum analysis has been adopted in various ecological fields as a robust indicator of the ecological status and environmental pressures on an ecosystem. Body-size structured aquatic ecosystems typically exhibit a decline in numerical abundance or biomass with increasing body size. This body size distribution in a community is highly influenced by trophic interactions and environmental pressures such as invasive species or pollution. In this study, we compared the community body size distribution and its underlying energy flow patterns among different lentic ecosystems from various regions worldwide, taking into account the environmental and ecological characteristics of each system. Data were obtained from several lentic water bodies located in three different regions of the world: water reservoirs in Spain, swamps in Colombia and lakes in Fennoscandia. For each fish system, we applied the Normalized Biomass Size Spectrum (NBSS) and abundance-biomass comparison (ABC) curves to assess the status of the fish communities. The slope and intercept of the NBSS were then calculated with linear least-squares regressions between the logarithm of biomass and the midpoint of each log2 size class. Subsequently, we examined whether the slope and intercept of the community size distributions were predicted by a set of ecological variables such as fish trophic position, environmental characteristics, and proportion of piscivores or exotic fish species. The results show significant differences in NBSS both within and among communities from the different regions. The slope and intercept of NBSS show that trophic position of species composing the different fish communities may play a major role in structuring fish size distribution in each system. In addition, our results confirm the high abundance of introduced fish species in the Spanish reservoirs. With increasing alien species abundance, the systems were dominated by r-selected species, and the biomass curves were below the abundance curves.

Management of invasive alien fish in Girona ponds: strategies, methods, and results

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Abstract content: For the past five years, Sorellona has been carrying out actions aimed at the ecological improvement of ponds, in the urban area, or in the natural landscape, of the Girona district. Within these actions, the eradication of invasive alien fish species is one of the most common actions, combined or not with other actions. The methodology used is detailed and the results obtained so far are presented. The management of invasive exotic fish in these environments is strategic for the conservation of these aquatic ecosystems. An essential part of planning actions is the selection and implementation of specific techniques adapted to each type of pond and the invasive species present. This can include various methods, such as complete casts and fishing with various capture techniques. The actions carried out for extraction are described, and the challenges and opportunities associated with this activity are also analyzed. Continuous monitoring of invasive exotic fish populations, and their effects on aquatic ecosystems, is also an essential part of these initiatives. The management of invasive exotic fish in ponds requires an approach that considers the particularities of each site, and involves the participation of local communities, conservation experts and competent administrations. With a combination of control, prevention, and restoration, it is possible to mitigate the impacts of these invasive species, improve the ecological state of aquatic ecosystems, and increase the chances of recovery of certain protected native species.
These actions receive funds from the *GiroNat* project (Fundación, Biodiversidad, MITERD), and the *Projecte Escanyagats* (supported by Catalan administrations). We are grateful to more than 40 owners of the different ponds, whether private or local administrations, such as the Girona City Council.

Trends and evolution of the invasive fish species in different bodies of water (rivers, wetlands and dams) of the Comunitat Valenciana

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Abstract content: Biodiversity worldwide confronts a multitude of threats, and invasive fish species (IFS) rank among the most significant perils to biological diversity. With the aim of conserving and managing aquatic environments, the surveillance efforts targeting both native and alien species emerge as indispensable tools for addressing and studying the fish population trends. In this respect, the "Dirección General del Medio Natural y Evaluación Ambiental" began to elaborate from 1987 a database based on the surveys carried out on inland fish populations within the Comunitat Valenciana (Spain). The surveys reported data on native and IFS, which made it possible to detect trends in some fish populations and to assess possible changes in certain ecosystems. Using this database, this study shows an in-depth analysis of the trends of several water bodies from different origin (rivers, wetlands, and dams). The database currently contains records of 3.963 surveys, with 377.936 caught belonging to 40 different fish species (57% belong to native fish of 27 species, and 43% belong to IFS of 13 species). In this respect, it is important to note that until the year 2000, only 3-5 exotic species were detected during the surveys, but since the year 2000, this number has increased alarmingly to reach 13 IFS in the C. Valenciana. On the other hand, it is important to remark that presence of IFS was different according the to the water body studied: dams (5), wetlands (12), and rivers (16). According to that, whereas in the dams IFS clearly predominate over native species (9 vs 5), in the wetlands the presence of IFS was lower than native species (9 vs 11). Finally, data collected from rivers showed that native species clearly predominated over IFS (18 vs 12). However, detailed data show that the situation is river-dependent, and there are 6 rivers in which IFS predominate over native species. Summing up, these data represent a very useful tool, which should be carefully analyzed to extract as much information as possible to manage the IFS in the C. Valenciana region.

Assessment of selective fish passage across a steep low-head ramp: a mesocosm approach

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Abstract content: The construction of small instream barriers, far more numerous than dams, has greatly contributed to river fragmentation, obstructing the movement of organisms, and reducing the amount of available habitat for native fishes. However, instream barriers that block the upstream movements of fish can be beneficial when the species that are prevented from moving upstream are non-native invasive fish that would affect the former by predation, interspecific competition, hybridization or transmission of diseases. This places a dilemma for fisheries managers: how can access to habitat be improved for native species, while excluding non-native ones? The present study aimed to assess the selectivity of a small instream barrier, a steep (120%) low-head ramp, for successful movements of a native (the Iberian barbel, *Luciobarbus bocagei*), a translocated (the Pyrenean gudgeon *Gobio lozanoi*) and a non-native invasive (the bleak, *Alburnus alburnus*) fish species under experimental mesocosm conditions. Two variables were recorded: i) the number of attempts (AT) to negotiate the ramp and ii) the number of successful negotiations (S), which were later used to calculate passage efficiency (PE%= S/AT × 100). Both upstream and downstream passes were allowed, so that fish could negotiate the ramp multiple times. Overall, AT was significantly higher for the barbel (N=128) relative to the gudgeon (N= 30) and the bleak (N=80) (Kruskal-Wallis H= 38.3, P< 0.001). PE(%) was also far superior for the barbel than for the gudgeon ($\chi 2$= 10.1, P< 0.01) or the bleak ($\chi 2$= 25.3, P< 0.001: accordingly, thirty-four ramp successful negotiations were reported for the former-resulting in an overall PE (%) of 26.6-whereas no gudgeon or bleak individuals were able to negotiated it (PE(%) = 0). The results of the present study improve the knowledge on the selectivity of small barriers for fish migration and can be useful to managers in river basin management where non-native invasive species are a concern.

Redrawing the biogeography of Iberia freshwater fishes in the Anthropocene

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Abstract content: Geographical events such as the formation of river systems and mountain ranges have acted as both facilitators and impediments to the dispersal of freshwater species, and allowed the high endemicity of freshwater biota in the Iberian Peninsula. With the increasing establishment of non-native species, it is now ripe to look at the current biotic communities across Iberian streams and rivers if we aim to curb the current biodiversity loss. In this study, we aimed to characterise fish communities in the Iberian Peninsula. A dataset regarding the occurrence of native and non-native fish species in the Iberian Peninsula was prepared from GBIF, Carta Piscícola Española and scientific publications since the year 1634, along with environmental and anthropogenic information. In total, we compiled 302390 occurrence records of species, 31345 sites (i.e., unique locations) and 98 species in an access database linked to a geographic information system. Environmental variables summed 300. The native species have 44% of endemicity, with 58% belonging to the Cyprinid family. From year 1845, there has been an exponential increase in the establishment of non-native fishes most from Europe and Asia, and now reaching 27 species. Importantly, 44% of the species are at risk of extinction according to IUCN global assessment, and the Guadiana Basin remains the host of the highest concentration of such species, with many stream reaches having >5 species at risk of extinction. The ordination analyses revealed non-native species tend to occur in stream reaches with higher human footprint. Similarity analyses revealed biogeographical patterns previously known have become eroded. The dispersal and colonisation of species into previously isolated regions lead to the breach of biogeographic barriers in freshwater ecosystems. Restoring natural flow regimes and habitat conditions may reduce biotic homogenization by favouring regional native species over cosmopolitan, and often predator, non-native species. Nevertheless, the control of new introductions remains key, preserving Iberian fish communities and known biogeography.

Navigating the Brine: Physiological Responses under Different Salinities Reveal Insights into the Interaction between a Native and Invasive Freshwater Fish

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Abstract content: Species interactions are intrinsically related to environmental conditions, yet our understanding of the physiological mechanisms underlying diverse environmental tolerances is limited. This knowledge gap could be crucial to better comprehending the variety in species performance and, consequently, understanding the context-dependent nature of species interactions. Using the interaction dynamics between the eastern mosquitofish (*Gambusia holbrooki*), one of the world's worst invasive alien species, and the endangered Spanish toothcarp (*Aphanius iberus*) as a case study, we explored the impact of salinity. Although it is well documented that salinity affects mosquitofish condition, aggressive behaviour, and prey capture, thereby limiting the invasive success of this species, the metabolic and physiological mechanisms underlying this reduced capacity remain unexplored. Here, our aim is to address this knowledge gap by examining the metabolic responses of these two species at different salinity levels (freshwater, 15 psu, and 40 psu). Using intermittent-flow respirometry, we determined the metabolic rates (standard metabolic rates, maximum metabolic rates, and absolute aerobic scope) from oxygen consumption data in the three salinity treatments. The data reveal distinct allometric relationships between the two species. Interestingly, as salinity increased from 0 to 15 psu, metabolic rates decreased for mosquitofish but increased for toothcarp. These results support the hypothesis of mosquitofish exhibiting lower salinity tolerance, highlighting toothcarps' potential euryhaline traits, and suggesting a possible osmoregulatory strategy enhancing both salinity coping and metabolic rates. Body weight, however, did not significantly interact with salinity, indicating no clear contrasting salinity effects across different masses within the two species. These findings contribute to understanding the invasion limits of mosquitofish and highlight the challenges it faces in competing with native species in hypersaline habitats. Furthermore, it emphasises the importance of considering intricate physiological mechanisms in the context-dependent competition of this global invader. This consideration is particularly crucial when evaluated alongside other influential abiotic factors such as oxygen availability and temperature, which are expected to play a paramount role in forthcoming ecosystems.

Are Portuguese inland professional fisheries fond of European catfish?

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Abstract content: The perception of professional fishermen in inland waters towards invasive fishes is understudied, but this stakeholder group can be essential to implement management actions targeting invasive fishes, by increasing fisheries pressure or participating in population control programmes. In this study we performed survey-questionnaires to the professional fishermen community from different Portuguese river basins about their perception, attitudes, behaviours and socio-economic impacts regarding the presence of the European catfish (*Silurus glanis*) in Portugal. Direct survey-questionnaires were carried out in-person or by telephone to fishermen operating mainly in the three main Portuguese river basins (Tagus, currently recorded; Douro, sporadically recorded; and Guadiana, not recorded). Overall, the fishermen community is represented by males, aged over 50 years old, experienced (>20 years of fishing), fishing several days per week near their homeplaces. The European catfish is not a targeted species but Tagus fishermen report catches of more than 50 individuals per year. More than 95% of the surveyed fishermen agree that *S. glanis* has negative impacts on other fish species, mainly through predation. All the fishermen remove the European catfish they catch from the river despite their residual economic value. Such a negative vision of European catfish by professional fishermen is an opportunity to involve them in population control programs, but valuing their catches is mandatory to enhance their motivations. Food and/or animal feed utilization can become a valorisation path which is starting to develop. A similar survey was already performed to Portuguese freshwater angling community and, even with the negative vision of the majority of the anglers, half of them still practice illegal catch and releasing of *S. glanis* and other non-native species.

Detection of European catfish (*Silurus glanis*) using hydroacoustics in the lower Guadalquivir

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Abstract content: This study is part of the "STOPSILURO" project, which aims to assess the extent of invasion by the exotic species *Silurus glanis* in the lower Guadalquivir. Specifically, the presented results correspond to the detection of this species using hydroacoustic techniques. The sampled area extends from the Alcalá del Río reservoir to the confluence of the Guadalquivir River with the Guadiamar River. Additionally, the El Gergal reservoir and the Ribera de Huelva River, from the dam of the reservoir to its confluence with the Guadalquivir River, were also included in the sampling. Hydroacoustic sampling was carried out in spring 2023, using a scientific echosounder model Simrad EK60 equipped with a 200 kHz split-beam transducer. Surveys were conducted both vertically and horizontally to sample the entire aquatic ecosystem, including both pelagic and littoral zones. Sonar5 Pro software was employed for the hydroacoustic data analysis. Once the raw acoustic data were noise-cleaned and prepared, the acoustic signals were analyzed to detect individuals that could correspond to European catfish based on their size. To ensure that the signal could only come from adult European catfish, a minimum threshold of 1 m total length was selected, since no other fish species was expected to reach such body length. The detected specimens were georeferenced in the respective study area. The results confirm the presence of European catfish in the El Gergal and Alcalá del Río reservoirs, as well as in the Ribera de Huelva River and the Guadalquivir River from the Alcalá del Río dam to Coria del Río, with the highest detection zone being between La Rinconada and Seville.

New approaches for capturing the invasive European catfish and its applicability on population control

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Abstract content: The European catfish (*Silurus glanis*) is a large apex predator that has invaded several watersheds in the Iberian Peninsula. Due to its generalist predatory habits, it has a broad impact on recipient communities, becoming particularly damaging to Endangered, Threatened and Protected (ETP) native species. Consequently, it represents a major challenge to the conservation and management planning of Iberian watersheds. In the frame of the project MEGAPREDATOR, new approaches to optimize catfish captures while diminishing bycatch, particularly of native species, have been tested both in lotic and lentic habitats in the Tagus watershed in 2023. A total of 225 gillnets ranging from 5 to 220 mm in mesh size and 216 longlines in different configurations of bait, position, and sound attraction use, were settled at 6 different waterbodies. Gillnets captured 2686 individuals, from which 87 were catfish, determining an average catch of 0.39 catfish *per* gear. In turn, longlines captured 132 individuals, from which 127 catfish, making up an average catch of 0.59 catfish *per* gear. Despite more laborious, longlines showed a much lower bycatch than gillnets (3.8% *vs* 96.8%, respectively), and captured bigger catfish than gillnets (total length in centimetres [30,183] vs [16,142], respectively). Catfish captures were higher with alive bait, particularly pumpkinseed fish (*Lepomis gibbosus*), followed by largemouth bass (*Micropterus salmoides*) and barbel (*Luciobarbus bocagei*), being caught catfish length proportional to bait size (r=0.455). No differences in captures were found in relation to the the position of the longlines, but the use of sound attraction increased the number of captures in about 2:1. Although preliminary, the use of longlines with sound attraction may help optimize the capture of European catfish and may be useful on the population control of this invasive species in the Iberian Peninsula. Further analysis will benefit from professional fishermen enrolment in population control campaigns in selected waterbodies, which will provide additional data that will put forward the new approaches, test these preliminary results and strengthen the analysis.

A genetic perspective on the invasion history of the European minnow (*Phoxinus* spp.) in the Pyrenees and the Italian Alps

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Abstract content: The Phoxinus species complex in Europe comprises several small freshwater fish commonly known as minnows, exhibiting complex genetic relationships and variations across populations and regions. Minnows are often introduced to originally fishless mountain lakes for recreational angling purposes, but they have negative consequences for habitats and native species. Usually, it is not clear from what populations the introduced minnows come from, but the irregular nature of these introductions prefigures a complex scenario, with both short-and long-range translocations. To enhance understanding of minnow xeno-diversity and introduction routes, we sequenced cytochrome c oxidase subunit I (COI) and cytochrome b (Cytb) from 201 individuals from 64 localities, including mountain lakes and downstream rivers from the Pyrenees and the Western Italian Alps. We identified four species of minnow: P. dragarum, P. bigerri, P. septimaniae, and P. csikii. The occurrence of multiple haplotypes was commonly observed at many sites, and in some other cases, two coexisting species have been found, indicating multiple introductions. The frequency of multiple species and haplotypes was higher in lakes under insufficient protection rules (e.g., where fish stocking a live-bait fishing is allowed), suggesting that fishing regulations are a key tool to combat the spread of alien fish. Results show that both short-range translocations from downstream habitats and long-range transboundary translocations may occur. The latter are particularly worrying because, in addition to their ecological impact on lake ecosystems, they could represent a source for further spreads with possible negative effects (e.g., hybridization, competition) for native minnows inhabiting lowland areas. If ever necessary, our results offer further evidence that introducing fish, and in particular minnows, in mountain area is a detrimental practice which should be avoided adopting conservation measures and actions aimed at reversing the biological invasion of mountain lakes.

On the eDNA-mapping of the monster European catfish threatening Doñana: The STOPSILURO Project

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Abstract content: The European catfish (*Silurus glanis*, Linnaeus, 1758) is the largest freshwater fish in Europe and a voracious piscivorous predator. The species was introduced into the Ebro basin in Spain in 1974 for recreational purposes and since then has spread throughout the country's river basins, reaching the Guadalquivir river basin in 2011. This basin, where the Doñana National Park is located, treasures a high number of freshwater species, some of them with a very significant commercial relevance, which makes it one of the most important biodiversity hotspots in Andalusia. Recently *S.glanis* presence has been reported in the Ribera de Huelva and it is feared that the invasion has advanced towards the middle and lower areas of the Guadalquivir River. The 'STOPSILURO' project aims to update the species distribution and dispersal patterns, as well as develop control measures in invaded areas to limit its effects and hinder its expansion towards regions of high ecological or socioeconomic value. The objective of this work was to detect and quantify the presence of *S.glanis* in the Guadalquivir River using molecular techniques based on environmental DNA (eDNA). Twenty-three locations were sampled in the riverbed and reservoirs of the Guadalquivir river basin in the summer of 2023, to collect environmental DNA and detect the species specifically by real-time PCR (qPCR) and digital PCR (ddPCR). The results demonstrate that the newly developed methodologies allow the detection and quantification of *S.glanis* eDNA and provide valuable information on the presence of the species. We have confirmed the presence of *S.glanis* in the reservoirs and upper and middle reaches of the Guadalquivir River including Seville and an area located much further south, suggesting other punctual introductions and/or human-mediated movements of specimens. The expansion of catfish into the environment of Doñana is a real threat to this Natural Area and requires a coordinated strategy of prevention and mitigation.

Is it time to replace traditional analysis with metabarcoding methods in diet studies? A case study assessing european catfish predation on native communities

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Abstract content: Understanding the trophic interactions between invasive and native species is essential for evaluating the potential disruptions caused by invasive species. However, characterising an individual's diet through traditional morphological analysis of stomach contents is not only reliant on taxonomic expertise but also limited by the extent of prey digestion. Metabarcoding offers a promising solution to these challenges, allowing for the identification of diet composition at a high taxonomic resolution, but also has its limitations. In this study, we evaluated whether metabarcoding of intestinal contents is superior to traditional stomach content analysis for characterizing the diet of the european catfish (*Silurus glanis*), an invasive top predator in Iberian rivers. We focused on detecting predation on bony fish throughout seasons and predator ontogeny (using total length and dimensional classes-< 50 cm; 50-100 cm; > 100 cm), by analysing 185 individuals from the Lower Tagus River. Metabarcoding detected higher *taxa* richness than traditional analysis (23 vs 13, respectively), with some endangered native fish species being only detected using this method. This may partly be related to the high percentage of empty stomachs (55.5%) in traditional analysis. The most common prey were shared between methods, including native migratory, endangered and economically valuable *Anguilla anguilla* and *Alosa* spp., native migratory *Chelon* spp., native *Luciobarbus* spp., and non-native *Lepomis gibbosus*. However, some differences were found between methods in prey detection over seasons. For example, *Alosa* spp. was first detected in Winter using metabarcoding, but only in Spring with traditional analysis. Additionally, prey *taxa* richness was highest in Autumn with metabarcoding and in Winter with traditional analysis. Moreover, variations in prey richness with predator size were only detected with metabarcoding, with smaller individuals consuming mostly *Gambusia holbrooki* and *Anguilla anguilla* and larger individuals *Lepomis gibbosus, Chelon* spp., *Luciobarbus* spp. and *Alosa* spp., in Spring. Overall, metabarcoding was found important for assessing predation patterns of *S. glanis* on fish communities that may be missed through traditional analysis due to constraints on prey ingestion, regurgitation, and digestion.

eDNA techniques unveil the dietary and distribution patterns of the invasive Eastern mosquitofish in Spain: Insights for Endangered toothcarp conservation

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Abstract content: The application of environmental DNA (eDNA) techniques has emerged as a promising tool in conservation biology, enabling the monitoring of threatened populations, the early detection of invasive species, and the implementation of dietary studies for understanding possible adverse effects of non-native species on native ecosystems. The Eastern mosquitofish (*Gambusia holbrooki*), listed among the world's 100 worst invasive species, was introduced to the Iberian Peninsula in the 1920s to combat malaria vector mosquitoes. However, its rapid spread has severely threatened the populations of two endangered and endemic Cyprinodontiformes in Spain: The Baetican toothcarp (*Aphanius baeticus*) and the Spanish toothcarp (*Aphanius iberus*). Therefore, this study aims to uncover the current distribution patterns of *G. holbrooki* and investigate whether its negative impact on toothcarp populations is due to competition, predation, or both following a comprehensive diet analysis. Our findings have revealed that both competition and predation are likely and that *G. holbrooki* presents a widespread range, residing throughout the entirety of the Baetican toothcarp´s and the Spanish toothcarp´s area of distribution. In light of these results, we aspire to enhance the conservation management of both *A. baeticus* and *A. iberus*, taking into consideration the presence of the Eastern mosquitofish and including initiatives such as habitat restoration and invasive species control. Our study emphasizes the value of eDNA techniques and their integration into conservation frameworks by addressing the negative impacts of *G. holbrooki* and the need to safeguard endangered toothcarp populations.

Beyond nets and scales: using social media data mining and eDNA to update European perch (*Perca fluviatilis*) invasion in Portuguese freshwaters

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Abstract content: Invasive alien species (IAS) pose major threats to biodiversity and ecosystem function, as highlighted in the recent Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report. Globalization and climate change are expected to exacerbate the IAS problem, leading to a rise in numbers and impacts presented by IAS introductions. Moreover, the confined nature of freshwater ecosystems can exacerbate IAS impacts. One of Portugal's latest invaders is the globally introduced, European perch (*Perca fluviatilis*), wich has documented worldwide detrimental ecological consequences. A fast-growing, ecologically adaptable and generalist fish with a high potential for ecological impacts. Currently, the European perch is in its initial invasion stages in mainland Portugal, being first detected in 2013, in one reservoir. Due to its potential for recreational fisheries, there is a high interest by anglers, with documented instances of illegal introductions into new water bodies. To effectively manage this invasion and mitigate potential impacts, it is crucial to accurately assess the European perch current distribution in Portuguese freshwaters. Often during initial invasion stages, it is common that IAS exhibit low abundances making detection difficult with traditional monitoring methods. Moreover, these can be costly, time-consuming, and impractical to implement across all potentially affected water bodies. To update the current distribution of European perch in Portuguese freshwaters, we used a three-pronged monitoring approach: First, we analyzed social media posts from fishermen to identify new perch populations. Secondly, environmental DNA (eDNA) samples were collected close to introduction areas and in suspected localities to detect/confirm new populations that might go unnoticed. Finally, we used scientific sampling (gill netting and electric fishing) to confirm new populations and spatially define with more detail the species current distribution. From this effort, three new populations have been identified, while other two are suspected but, so far, not confirmed. Combining social media and eDNA analysis offers a cost-effective and scalable solution for tracking the spread of invasive fishes. Early detection and rapid response are essential to mitigate the potential ecological impacts of IAS on recipient communities.

Reeling in the Clicks: online interest in Iberian freshwater fish

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Abstract content: Freshwater fish of the Iberian Peninsula are exceptionally vulnerable to a myriad of threats, particularly the one posed by invasive fish. Preventing introductions and targeting the early stages of invasion are the most cost-effective management options for the spread of invasive species. Because these approaches directly depend on people's attitudes and perceptions, insights from an increasingly data-rich world offer an excellent opportunity to understand public interests and provide instruments to raise awareness of the risks posed by NN species. New media devices dominate the lives of many people, generating large amounts of readily available data concerning individuals' online presence that translates how societies perceive biodiversity. Recently, the emerging field of culturomics brought technological advances to the analysis of online data regarding biodiversity and conservation-related themes, which allows us to uncover complex relationships between societies and the natural world. The main objective of this study was to evaluate what drives public interest towards Iberian ichtyofauna by assessing species' online popularity. For each fish species occurring in the Iberian Peninsula, we measured public interest as the sum of Wikipedia page views between 2015 and 2023. Regression analyses were used to relate Wikipedia page views to species' attributes, traits and economic significance. Results showed that online popularity was mainly driven by geographic range, body size and economic interest linked to commercial fisheries, aquaculture, and aquarophilia. Additionally, predator, gamefish, and non-threatened species tended to be more popular among Iberian fish. While threatened species lacked public attention, this study highlights a favouritism toward economically valuable species and features that are common among non-native fish. Unveiling the factors underpinning societal interests is a crucial step to optimize environmental education actions which may strongly contribute to the acknowledgement of the impacts of NN species by the general public to improve biodiversity conservation.

Availability of shoreline habitats is more important for native than for non-native fish species in Neotropical reservoirs

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Abstract content: Biodiversity is declining worldwide due to anthropogenic impacts, especially noxious for freshwater ecosystems, considering their close relationship with human activities. Damming is one of the most harmful human impacts that leads to the loss of several riverine fish through habitat loss or change. Herein, we aimed to assess the relationship between the composition of fish assemblages in reservoirs and the availability of submerged littoral habitats (i.e., rocks, shrubs, leaves, among others), and whether these patterns differ between native and non-native species. Fish assemblages of fifteen reservoirs from up to downstream the Paraíba do Sul river basin (southeastern Brazil) were evaluated through gillnet sets (60 m × 1.5 m; sections of 15, 30 and 45 mm mesh joined consecutively). Habitat availability was more important for native than for non-native species, after controlling for the influence of reservoir features according to RDAs, variation partitioning and a distance-based permutational analysis of variance). Local drivers (e.g., temperature, pH and transparency) were crucial for the occurrence of non-native species which thrived in the absence of complex habitats. Macrophytes seemed to play two key but quite antagonistic roles for fish species. They were positively related to native small characids (e.g., the small tetras *Astyanax* cf. *bimaculatus*, *Psalidodon* cf. *fasciatus* and juveniles of the pike characin *Oligosarcus hepsetus*) probably acting as shelter against predation, but they were also related to hypoxic conditions in eutrophic reservoirs. These findings stress the importance of preserving or restoring physically-complex habitats as beneficial for native fish species through providing grounds for feeding (catfishes on leaves) and recruitment (juveniles of characids in macrophytes banks).

Assessing fish assemblage ß-Diversity shifts following an intra-country introduction in Southeast Brazilian Reservoirs

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Abstract content: In Neotropical reservoirs, there are significant knowledge gaps concerning the invasion effects of intracountry species introductions, such as the amazon cichlid *Geophagus sveni*, which has been recorded in reservoirs of the Upper Paraná River basin in Brazil since the early 2000s. We hypothesize that this species exhibits high invasiveness and contributes to beta temporal changes in the native fish fauna of the Upper Paraná River, Brazil. To assess its invasiveness, we conducted the AS-ISK, consisting of 49 basic questions examining the biogeographical and biological aspects of the taxon. This assessment results in a Basic Risk Assessment score, with scores categorized as low (< 1), medium (1-18.9), and high (≥ 19). Subsequently, we compared these scores with those of other previously documented non-native species. Additionally, using presence/absence data matrices from long-term fisheries (1992-2015) of four large reservoirs (Ilha Solteira, Três Irmãos, Jupiá, and Porto Primavera) in Southeast Brazil, we calculated the temporal beta diversity index (TBI) of native species for each reservoir using the Jaccard dissimilarity coefficient. We decomposed the TBIs by gains/losses of species and correlated them with the invasive species abundance and over time using linear regressions. The score of *G. sveni* (32) classified it as having high potential invasiveness, along with *Cichla kelberi* (29) and *Plagioscion squamosissimus* (37). The loss of native species was positively correlated with the increase in *G. sveni* abundance in the Porto Primavera and Três Irmãos reservoirs. Additionally, for these locations, the losses of native species exceeded the gains and increased over time. Both reservoirs are new, and the samples were obtained following the formation of the dams, indicating that these results probably are related to hydrological shifts from lotic to lentic ecosystems. Furthermore, the competitive abilities and environmental tolerance of *G. sveni* contributed to its invasion and to replacement of native species following environmental changes. In conclusion, the invasiveness of *G. sveni* showed a high risk of invading new sites in southeastern Brazil and likely contributes to the decline of native species, particularly in young reservoirs.

Unraveling Invasion Dynamics: Assessing the Role of Adaptation and Naturalization in the Success of Cichla ocellaris Beyond the Amazon

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Abstract content: Freshwater ecosystems shelter a great diversity of species and provide essential ecosystem services. However, the integrity of their communities has been intensely threatened by anthropogenic activities such as damming and the introduction of invasive species, which are often associated. The Amazonian yellow peacock bass *Cichla ocellaris* has been widely introduced throughout South America for fishing purposes, despite being reported for pervasive impacts on the native fauna. While some abiotic factors related to the introduction and spread of *C. ocellaris* have been identified, most studies disregard their biotic interactions, which could elucidate patterns related to their invasion success, especially when considering hypotheses such as ecological facilitation, invasional meltdown and Darwin naturalization. We test the relative importance of adaptation and naturalization processes during the invasion of *C. ocellaris* in 62 freshwater ecosystems (32 rivers and 30 reservoirs) in the Neotropical region. We hypothesize that the success of *C. ocellaris* invasion in non-Amazonian regions is attributed to functional and phylogenetic differences between the receiving community and the fish community in the region of origin. To accomplish this goal, we performed a literature review to gather abundance data of fish assemblages as long as functional traits (FishBase and FishMORPH databases). Reservoirs played a role as retainers of non-native species outside the Amazon region, most of them introduced through sport fishing. We have also find that, despite the great fish diversity within the Amazon region, the peacock bass invaded freshwater ecosystems with phylogenetic and functional compositions more similar to its native region, in accordance with the Darwin's preadaptation hypothesis. Our zero-inflated model also showed a process of biotic resistance within the Amazon region (where non-native species were less common) and a biotic facilitation process in non-Amazonian regions (where, proportionally, more non-native species were found). Our findings are of great applied importance since this species have been continuously introduced throughout the world and also considering recent studies that have showed a great potential for establishment in novel tropical areas (e.g., especially in the African continent). Therefore, despite the climatic adaptability, it is important to consider that systems with depauparated fish faunas (e.g., reservoirs) may facilitate the establishment of the peacock bass.

Karst Pallars, conservation of karstic lakes in the Catalan Pre-Pyrenees. First results of the intensive population control of exotic fish in lake Montcortès (Baix Pallars, Lleida)

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Abstract content: The lakes of Montcortès and Basturs are authentic jewels of the Iberian Karst and, in general, of Southern Europe. Added to its geological uniqueness, is its great ecological interest due to the existence of habitats and species that are scarce and/or of interest for conservation on a national and international scale, such as habitat 7210 "Calcareous swampy areas with *Cladium mariscus*" or the White-clawed crayfish (*Austropotamobius pallipes*). Despite being within the Natura 2000 Network, these lakes maintain a negative trend in the conservation status of several species of interest. This negative trend also extends to the ecological state and water quality, which continue to deteriorate noticeably. Various factors play a role in this global situation of gradual ecological deterioration. But considering the underground origin of the water, these factors are mainly of a very local territorial scope, and apparently of possible management or solution. One of the most serious and obvious impacts is the presence of invasive exotic fish species. In the case of Montcortès, the introduction of the carp (*Cyprinus carpio*) and the crucian carp (*Carassius auratus*) dates back about 25 years and has had an evident effect on the quality of the water and habitats, although it has not been duly quantified. In the Estany de Montcortés, since 2022, a first phase of *the Karst Pallars* project has been carried out, including a main action based on the intensive control (experimental culling) of exotic fish. The results achieved are presented. Only during the first year, a reduction of more than 80% of starting stocks was achieved. This project is funded by the Department of Climate Action, Food and Rural Agenda of the Generalitat of Catalonia.

First **data on imported freshwater fish used on ornamental trade in Portugal**

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Abstract content: The trade on ornamental aquatic animals is a growing economic activity that encompasses a wider diversity of marine and freshwater organisms. Ironically, many of these ornamental animals are discarded into aquatic ecosystems, being freshwater fish widely introduced worldwide with unforeseen ecological consequences. Freshwater aquarism is a popular hobby in the Iberian Peninsula and records of new fish species arriving through this pathway are common. There is a direct correlation between the propagule pressure by imported ornamental species and the records of new species found in nature. Nevertheless, this industry is poorly regulated, with a high volume of species traded and a lack of systematic knowledge about the fish species imported to Portugal. In this study, we present the first assessment of the imported ornamental freshwater fish, quantifying the number of specimens per species, country of origin, frequency of records, among others. This was made possible by compiling information from the trade platform of Institute for the Conservation of Nature and Forests (ICNF) since 2019. A total of 11,000 fish records were identified, from 34 suppliers and ten different countries ranging from Southeast Asia to South America. The most common species were *Poecilia reticulata*, *Carassius auratus*, *Xiphophorus hellerii*, *Poecilia latipinna*, *Betta splendens* and *Cyprinus carpio*. This first data is essential to evaluate species risk of introduction into Portuguese freshwaters but also to identify high impact species that could arrive throughout the ornamental fish trade.

LIFE INVASAQUA: Policy Brief and Strategic Information for the Management of IAS in Aquatic Systems

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Abstract content: LIFE INVASAQUA has aimed to reduce the introduction and spread of aquatic IAS, among other actions, by developing instruments to improve the management and early warning framework in the Iberian Peninsula. One of the main actions has been the establishment of synergies and tools for environmental governance. Thus, in collaboration with more than sixty experts, management tools have been generated, such as updated lists of aquatic alien species and lists of priority invasive IAS (black list and alert list). In coordination with SIBIC, a beneficiary partner of the project, a web platform has also been developed to facilitate the transfer of geo-referenced information on taxa and to support the transferability of data to EASIN (European Alien Species Information Network). INVASAQUA has worked on the elaboration of strategic challenges that can help to improve the management framework for epicontinental fish at the Iberian level. The instruments and information generated by INVASAQUA aim to stimulate and support research, monitoring and management activities at local, regional and transnational levels. Key resources have been provided for environmental managers, NGOs and other stakeholders who may have a specific stake in IAS-related management actions. The results can also be applied to guide policy and identify priority IAS for inclusion in monitoring and research programmes, or which should be the subject of specific management plans. This work receives funds from the LIFE Programme (LIFE17 GIE/ES/000515).

Challenges and opportunities in aquatic ecosystem management: on the role of otoliths as a key tool for understanding ichthyological invasions

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Abstract content: Year by year the arrival and expansion of invasive species within our region becomes exponentially higher, putting the stability of native ecosystems at risk. One of the most threatened ecosystems and the most sensitive to the appearance of these species are aquatic ones. Currently, 32 invasive ichthyological species are known to be present in our water masses, half of which are present in the northern part of the country. The control of this type of species is essential for the conservation of the native ichthyological fauna, thus the use of new techniques is essential for a more detailed and complete understanding of the invasion processes. The study of sagittae otoliths is a widely used technique in the marine environment and allows us to understand relevant information such as the chemical composition of the individual's environment of origin, its capacity for development, stabilisation and recolonisation of populations, or the migrations processes, making it a highly interesting technique for studying the processes of introduction, expansion and settlement of invasive ichthyofauna. In this work we carry out a review of the invasive ichthyofauna present in the northern third of the Iberian Peninsula, as well as providing the first images of the sagittae otoliths of the main invasive species in the north of the Iberian Peninsula, providing the starting point for future morphometric studies and the creation of a database of invasive ichthyofauna present in the Iberian Peninsula.

Intensive control of exotic fish in a stretch of high interest for the native ichthyofauna of the Daró River (Girona)

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Abstract content: The medium-upper course of the Daró River, located within the Natura 2000 Network, presents a high biotic integrity of its fish population, currently exceptional in the lowland rivers of Catalonia, located below 200m a.s.l. Currently, it still maintains populations of four native species along a stretch of about 10 km, although its trend is globally regressive for all of them. These are the eel (*Anguilla anguilla*), the stickleback (*Gasterosteus aculeatus*), the mediterranean barbel (*Barbus meridionalis*) and the chub (*Squalius laietanus*). On the other hand, in this section there are only current records of two exotic species, pumpkinseed (*Lepomis gibbosus*) and goldfish (*Carassius auratus*), concentrated in a small area of just 500m. Here, various intensive control campaigns for sun perch and crucian carp have been carried out in 2012, 2020 and 2022. The actions carried out and the results achieved are presented. Each year of action has achieved a global reduction in the population of adult pumpkinseed of more than 90%, but this species persists in the area. As for the goldfish, it only appeared in 2020, and in that year its eradication was possible, without it appearing again. However, both species are still present in some private ponds located in the area, from where specimens can probably reach the river, even if only irregularly. Currently, within the framework of the *Projecte Escanyagats*, Sorellona is gradually acting on these ponds, to eliminate these nuclei of exotic species, and thus minimize their impact.

On the occurrence of *Carassius auratus* X *Cyprinus carpio* hybrids in the central Asturias (N Iberian Peninsula)

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Abstract content: In recent decades, globalisation, human activities, and global warming have facilitated the arrival and settlement of exotic species outside their native distribution range. These exotic species can produce negative effects in their new habitats and thus become invasive species. In particular, aquatic ecosystems with high anthropogenic degradation due to human activities seem to be an ideal scenario for the establishment of these species, causing severe ecosystemic consequences. During an ecological survey aimed at identifying the invasive fauna of urban areas in the central zone of the Principality of Asturias, a series of individuals with apparent signs of hybridisation between common carp (*Cyprinus carpio*) and crucian carp or goldfish (*Carassius auratus*) were found. To confirm this hybridisation, a morphometric and anatomical study of the different cyprinid individuals collected in an urban section of the Nora River (Oviedo-Siero) and from a pond in La Cebera park (Siero) was carried out. Analyses were performed on the length, width, number of lateral line scales, anal and dorsal fin rays, dental formula of the pharyngeal teeth, number of gill spines and presence of barbels. The results showed that the presence of individuals with intermediate characters were hybrids of both species. The finding of these hybrids in other countries shows that these species reproduce with each other in a reduced space and produce fertile offspring, and that these hybrids may have favourable traits with respect to their parents that make them more resistant, as it has been shown in other studies that they are resistant to herpesvirus-2 and herpesvirus-3. The knowledge that gene flow exists between common carp and crucian carp presents an additional challenge in the management of invasive species as they can act as reservoirs of genetic diversity where they coexist, facilitating their survival and adaptation to new environments.

Milkfish, Lionfish, and other exotic marine fishes in the Colombian Caribbean

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Abstract content: The milkfish [*Chanos chanos* (Forsskål, 1775)*, family Chanidae*] is a marine and estuarine bony fish widely distributed in tropical sectors of the Indian and Pacific Oceans. In November 2021 an 85 cm fork-length specimen of milkfish was fished off the Colombian Caribbean town of San Bernardo del Viento. No clear-cut explanation for the presence of this species in the Caribbean, but we would like to raise attention to this new exotic fish. The red lionfish *Pterois volitans* (Linnaeus, 1758) (family Scorpaenidae), without any doubt one of the fastest invasions recorded and followed of a marine fish. has been widely introduced in the eastern USA coast at least since the 80s as collateral damage of the aquarium business. In the short span of a few decades this scorpaenid went from isolated reports to the invasion of many continental and insular shelf habitats in the Caribbean and adjacent tropical and subtropical waters, going even to the upper slopes. It dwells in all the Colombian continental (from Chocó to La Guajira) and oceanic (Departamento Archipiélago) marine territories and habitats, sometimes in amazing numbers. It is a deleterious organism for marine biodiversity because it preys on a wide array of critters, including the early stages of many phyla, and is also a constant danger to divers. fishermen, and bathers because of its venomous fin spines. Other exotic marine fishes detected in the Colombian Caribbean are *Omobranchus punctatus* (Valenciennes, 1836) (family Blenniidae), *Eleotris picta* Kner, 1863 (family Eleotridae), *Oreochromis niloticus* (Linnaeus, 1758) (family Cichlidae) and *Trichopodus pectoralis* Regan, 1910 (family Osphronemidae).

First data on the biology of a wells catfish (*Silurus glanis*) population located in the south of the Iberian Peninsula

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Abstract content: The European catfish (*Silurus glanis*) is an Invasive Alien Species from Eastern Europe and Western Asia illegally introduced through different European countries, including Spain, mainly due to its popularity among fishermen. The only stable population in Andalusia is in the Iznájar reservoir (Iznájar, Córdoba) although there are pieces of evidence of a new population in the lower reaches of the Guadalquivir River. The knowledge of the biology and ecology of new populations is essential to start management programs to counteract the negative effects of these invasive species on the receiving habitats. In this study, we present the first data on the length frequencies, length-weight relationships, age structure and annual growth of this population based on the analysis of 254 individuals supplied by local fishermen. The age study was based on the analysis of the annual rings observed in sections of the pectoral fin radius. Vertebrae were extracted from 18 specimens for comparison and verification of readings. The maximum Total Length (TL) observed was 216 cm and 54,3 kg of maximum weight (W) in a specimenof 197 cm TL. The maximum age found was a male of 12+ (200 TL; 49,1 W). The results indicated that the Iznájar reservoir population has one of the highest growth rates of the whole of the populations analyzed.

Detection, delimitation and identification of invasive alien freshwater fish species by environmental DNA (eDNA) detection in water

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Abstract content: Biological invasions are one of the main agents causing biodiversity loss on a global scale. Freshwater ecosystems are one of the most vulnerable systems with the greatest concern. In the Iberian Peninsula, the vast majority of freshwater fish species are threatened by the presence of invasive alien species (IAS). European and national administrations urge to prevent, control and mitigate the damage caused by IAS at the European and national scales. Our project included in the CEICA 3088145 DNA project (Exp. 21 EBDES014) funded by the Directorate General for Biodiversity, Forests, and Desertification (MITERD, Ministerio para la Transición Ecológica y el Reto Demográfico), aimed to elaborate a detection protocol for IAS freshwater fish species using environmental DNA (eDNA) in water using metabarcoding analysis. Eight localities in the Tagus River basin were sampled in spring and autumn (2022-2023) using electrofishing and eDNA techniques. In general, eDNA metabarcoding results are concordant with electrofishing data although more species are detected in eDNA analyses than through electrofishing. Our findings indicate a strong presence of some invasive species such as the bleak (*Alburnus alburnus*) or the pumpkinseed sunfish (*Lepomis gibbosus*) throughout the Tagus basin, the expansion of *Pseudorasbora parva* in some Tagus tributaries since its first record in 2018, and the presence of the rudd (*Scardinius erythrophthalmus*) in the tail end of the Santillana reservoir (at headwaters of one of the tributaries of Tagus River). Our results show that the use of eDNA metabarcoding is a good non-invasive method to detect IAS and for monitoring the expansion of IAS species.

Iberian Aquatic Invasive Alien Species database: Current status of a critical tool to fight against IAS

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Abstract content: Invasive alien species (IAS) are one of the main global threats to biodiversity and represent a serious threat to endemic species. This situation is especially worrying in the Iberian Peninsula since Spain and Portugal's rivers and lakes host a unique wealth of endemic freshwater species. Knowledge about the presence and distribution of IAS or translocated species is an essential tool to prevent their further expansion. However, in many cases, this information is fragmented into different sources that are not always easily accessible to the administration, researchers or the general public. To reduce this problem as much as possible, the LIFE INVASAQUA project (LIFE17 GIE / ES / 000515), financed by the LIFE program, proposed the creation of a database that would integrate the existing information on Iberian aquatic IAS and translocated species. The database is accessible online (https://eei.sibic.org/) and provides information to other platforms such as EASIN (https://easin.jrc.ec.europa.eu/easin) and IBERMIS (https://ibermis.org/). Currently, there are 503 registered taxa for which information is being collected (the main groups being fish, crustaceans and molluscs, in that order), of which almost half have their information visible. To date, more than 25,000 records (mainly fish, molluscs, and crustaceans) have been collected from about 1,700 different sources. The database is constantly improving through the search and addition of new information, inviting institutions and administrations to share their data in order to improve knowledge about IAS and prevent their further expansion.

What do we know about the invasive cichlid chanchito, *Australoheros facetus*, in the Iberian Peninsula?

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Abstract content: Chanchito is a neotropical cichlid originally from eastern south America (Brazil, Uruguay and Argentina), now present in the wild in Southern Portugal and Spain, and in central Chile. To evaluate its invasive potential and future success under different climate scenarios, we studied its distribution, tolerance to abiotic factors and environmental change, social behaviors, parental care, endocrine physiology in the context of hierarchy formation and reproductive behavior and aimed to disrupt reproduction by chemical castration. The species occurs in small Mediterranean streams with striking seasonal variations in temperature and hydrological regimes, but its range appears to be expanding, most likely due to human action. Fish showed wide thermal tolerance, with CTmin=2°C and CTmax=39°C and tolerance to hipoxia. Metabolic rates at 8C, 18C and 28C, showed wide individual amplitude but elevated aerobic scope throughout. Tolerance to salinity is reduced above isosmotic levels, with up-regulation of gill NKA activity and increased cortisol levels at 15ppt. Growth and social behavior are abolished at 18ppt. Behaviour is highly affected by temperature, with territorial aggression ensuing within hours above threshold temperatures. Dominance indexes correlate to fish size, but not to sex, GSI or HIS. Cortisol and 11K-testosterone (11KT) are elevated among both dominant and subordinates males but not in females of different status. Monogamous pairs defend breeding territories and show differentiated parental roles (caring, patrolling, chasing). EOG shows higher nerve activity in response to fluids of dominant than subordinate fish. Carbenoxolone is effective in reducing 11KT in males but impacts on fertility are yet unknown.

A mesocosm experiment on the competitive interactions between an endangered toothcarp and invasive mosquitofish under hypoxic conditions

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Abstract content: The invasive success of alien species is driven by the interplay of abiotic and biotic variables that shape the resilience of the invader. The eastern mosquitofish (*Gambusia holbrooki*) is among the most invasive alien species in the world, with marked impacts on native fish and amphibians. The Spanish toothcarp (*Aphanius iberus*) is one of the most endangered Iberian vertebrates due to habitat destruction and displacement by mosquitofish. Mosquitofish and Spanish toothcarp compete in shallow lagoons affected by drought and eutrophication.

We performed a mesocosm experiment on the competitive interactions between mosquitofish and the toothcarp under eutrophic, hypoxic conditions. We used a response surface design, with six treatments, two fish densities of 5 and 32 fish m^{-2}, and single or two species, which allows to examine the direct effects of intraspecific and interspecific competition for food and space. The indirect effects of mosquitofish on water quality were also studied by measuring the turbidity, dissolved oxygen, conductivity, chlorophyll *a,* and the ratio of total nitrogen and total phosphorus (TN:TP).

We observed changes in fish survival, growth, and condition after 48 days. Mosquitofish produced a clear effect on water quality, increasing turbidity, chlorophyll *a*, and the TN:TP ratio. Furthermore, competition resulted in reduced, growth, and condition, benefitting the survival of mosquitofish. Mosquitofish reproduced in the low-density treatment. These results confirm that mosquitofish produce trophic cascades in eutrophic waters. Resource competition and a high reproduction rate might help mosquitofish outcompete native fish species. Our results also suggest that to understand species coexistence it is important to also analyse the indirect effects of alien species on ecosystems, for which mesocosm experiments are an invaluable tool.

Biodiversity loss by hybridization of invasive species with endemic freshwater fishes

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Abstract content: Biological invasions can negatively affect freshwater fish biodiversity and ecosystems at several levels. The establishment of alien freshwater fishes results in increased competition for food and space, predation and risk of hybridization and genetic introgression. Interbreeding between alien and native species increases the likelihood of extinction of native species, particularly those inhabiting highly fluctuating systems in which temporary streams and rivers commonly form, such as those found in Mediterranean freshwater systems of the Iberian Peninsula. Hybridization between endemic and invasive alien species and subsequent backcrossing is considered a serious threat to endangered or rare endemic species. However, the extent it occurs is often underestimated by conservation biologists. We studied the genetic and morphological characteristics of hybrids of sympatric native cyprinids (*Iberochondrostoma lemmingii*, *Pseudochondrostoma willkommii* and *Squalius alburnoides*) and the bleak (*Alburnus alburnus*) an invasive fish in four streams of the Guadalquivir basin (SW Spain). Fish morphology was analyzed using geometric morphometrics and molecular identification of parenthood was inferred though the mitochondrial cyt b and the nuclear Beta-actin genes. Molecular analyses confirmed hybrids between the invasive bleak and *S. alburnoides* in a stream with continuous flow. Haplotype analyses suggested that they originated from backcrossing of hybrid offspring. We have also detected intergeneric crosses between native cyprinids in streams under reduced connectivity scenarios. Morphometric analyses revealed that hybrid phenotypes were similar to *S. alburnoides*, and in some cases, molecular markers uncovered hybridization events no detected in morphometric analyses supporting a backcrossing scenario. We hypothesize that current extreme seasonal conditions can increase hybridization in Mediterranean rivers and become a serious problem for native species where invasive species are present.

Environmental and human drivers shape the trophic ecology of a widespread marine predator

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Abstract content: Developing ecosystem monitoring tools for the dynamic management of marine resources, species, and ecosystems is becoming increasingly important. Integrative approaches that consider diet drivers may provide the necessary means for exploring and predicting changes in food-web dynamics under contrasting scenarios of global change. However, few studies have analyzed the relationship between environmental factors and trophic interactions, and none of them have considered additionally other human stressors such as fisheries. Here, we explore the relationships among diet and biological, environmental, and anthropogenic drivers in swordfish (*Xiphias gladius*), the most widely distributed billfish, in response to environmental patterns and fishing pressure. We used Bayesian Stable Isotope Mixing Models (BSIMM) to estimate the diet of swordfish based on stable isotope values (δ15N and δ13C) from muscle samples collected in the western Mediterranean Sea and the adjacent Atlantic waters. We then fitted Generalized Additive Models (GAM) to evaluate the relationships among diet estimates and biological, environmental, and anthropogenic drivers. Spatial predictions of present prey consumption are produced and, as a prospective exercise, GAMs were also used to predict changes in prey consumption under different climate change scenarios. Overall, we found that swordfish diet may vary spatially and temporally as a likely response to changing environmental conditions, particularly associated with sea surface temperature (SST), dissolved oxygen (DO) and chlorophyll-a concentration (Chl); as well as to fishing pressure. Fish consumption was positively related to SST, and decreased with increasing DO levels. In contrast, squid were more consumed at lower SST and by swordfish of intermediate lengths. Squid had a higher diet contribution around the Canary Islands and the western Mediterranean Sea, while gelatinous organisms were more consumed around the Gulf of Cádiz. The consumption of gelatinous organisms was higher in areas with lower productivity, intermediate DO levels, and by smaller swordfish. For the first time, we provide quantitative evidence on how large-scale, spatial-temporal patterns in fishing pressure and environmental conditions can shape the diet of swordfish. Our framework presents a useful tool to monitor the diet of these predators as a first step towards adaptive management of this commercially important resource.

Effect of attraction angle on flow-refuge use effectiveness by a potamodromous species, the Iberian barbel (*L. bocagei*) under simulated pulsed-flow

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Abstract content: Changes in daily electricity demand cause artificial pulsed-flows downstream of hydropower plants, altering the biological and physical properties of rivers. This may cause fish drift and change patterns of habitat selection. The present study was conducted in an indoor flume to assess the attraction efficiency of the Iberian barbel (*Luciobarbus bocagei*) for two flow-refuges with different approaching angles (45º and 70º). The flow-refuges underwent testing under two artificial flow conditions: base (BF) and pulsed-flow (PF). A total of 100 animals were tested, divided into 20 replicates. To assess the efficiency of the flow-refuge as a mitigation measure for pulsed-flows, we quantified the frequency of use and permanence time by fish. These metrics were assessed for individual fish and groups of 2-5 fish. We also measured blood glucose and lactate levels as indicators of stress to quantify physiological responses. The permanence time inside the 45º flow-refuge was higher than in the 70º refuge. However, this difference was only marginally significant (p=0.053) and therefore was not considered a significant result. The frequency of use results (mean ± SD) indicated that during the simulated pulsed-flow, barbels used the 45º flow-refuge more often (PF45: 39.4 ± 21.18; PF70: 25.60 ± 10.31). However, the simulated pulsed-flow did not trigger group behavior for either approaching angle (p=0.09). Similarly, the events that were created did not elicit any physiological responses, as evidenced by the lack of changes in blood glucose and lactate levels in the tested trials (p= 0.274; p=0.123, respectively). The fish exhibited greater preference for the 45º flow-refuge compared to the 70º flow-refuge. This preference can be attributed to the fact that the 45º flow-refuge generates higher speeds and a more uniform flow-field, which enhances the rheotactic behaviour of the fish and increases its attraction potential. Further research is required to consider the angle of attraction when placing a refuge in the river. This study suggests that tighter angles, particularly the 45º angle, are suitable. This is crucial for understanding the dynamics, especially for cyprinids in rivers affected by peaking flows. Additionally, flow-refuges should also be considered as a potential indirect mitigation measure under such conditions.

Uncovering the extent of phenotypic variability in the behaviour of an aggregative riverine fish

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Abstract content: High phenotypic diversity is predicted to provide populations with resilience to environmental change as it increases their capacity to respond to changing conditions. However, the extent of this diversity has not been quantified in many species, with considerable knowledge gaps also remaining on how this diversity relates to physiological and life-history traits. In this study, the behavioural phenotypic diversity of European barbel *Barbus barbus*, which is an aggregative riverine fish that expresses individual differences in their behaviours in the wild, was assessed. Three behavioural experiments were completed in ex-situ conditions sequentially: 'open-field test' (exploring new habitats), 'mirror-image stimulation test' (social stimulus) and 'foraging behaviour test' (shy-bold traits), with each of these individual experiments lasted 20 minutes, were replicated three times and filmed. Only individuals who completed at least one of the experiments in each of their three replicates were included in analyses (n = 25) and 16 different behaviours (29 variables) were studied. Preliminary principal component analyses were performed on the data of each separate experiment to reduce the number of variables and select those of most relevance to the expressed behaviours, which were then used to construct a final PCA from which the proactive-reactive axis was extracted. Moreover, repeatability of behaviours was calculated using the variance components obtained from generalised linear mixed-effects models. Results showed that there was high variability in behaviours both within and between individuals, with this variability related to consistency in individual behaviours on a reactive-proactive axis. Within individuals, five behaviours showed repeatability, being the most repeatables latency to exit the shelter, active time in the shelter, and the number of food items consumed. Principal component analysis distributed the individuals along a reactive-proactive axis, indicating a range of consistent behavioural phenotypes across them, with 80 % of individuals displaying more reactive phenotypes (shyer, less exploratory, less social). These results suggest that within controlled conditions, barbel express considerable phenotypic diversity in their behaviour, suggesting some adaptive capacity to environmental change in their populations.

Fish behavioural and physiological indicators upon capture and at slaughter: a step towards increasing welfare in purse seine fisheries off the southern Portuguese coast

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Abstract content: Fish caught in purse seine fisheries undergo a multitude of stressors ranging from sensorial stress induced by engine and sonar devices to physical damage by the fishing gears, resulting in physiological stress induced by overcrowding, distress, injury and pain. When onboard the fishing vessel, they endure crushing, desiccation, and asphyxia in storage containers, resulting in a drawn-out death. This study aimed to better understand the impact of purse seine fisheries in the welfare indicators of the main target species off the southern Portuguese coast: European pilchard (*Sardina pilchardus*), Atlantic chub mackerel (*Scomber colias*), and Atlantic horse mackerel (*Trachurus trachurus*), as well as explore ways to reduce physiological stress until death. Fish were assessed at different moments during catching and storing in normal commercial operations and during tentative improvements in storing conditions with ice. All fish were scored for vitality and blood samples were taken to evaluate the production and accumulation of fast-acting quantifiable stress indicators (cortisol, lactate, glucose, haematocrit, and osmolality). Crowding conditions in the closed seine do not decrease the vitality in chub mackerel, but these show increased cortisol and lactate values, while in the pilchard the already increased physiological parameters in the first brail are coupled to a decrease in vitality in the crowded free-swimming fish. A rapid drop of vitality is observed when fish are placed on and under ice, or in ice-slurry, with a reduction in the accumulation of stress metabolites. Whether this reflects a reduction in metabolism or is also related to a decrease in perception and/or distress needs to be addressed. Using ice, relevant to maintain product quality seemed to hasten immobilization, especially in slurry form. However, even though it affects all species, chub mackerel often remain responsive for several minutes after immersion. Although ice storage should not be considered a stunning method nor a slaughter procedure, if deemed beneficial in reducing distress, it may be easier to adopt by fishers in the short term. Effective methods for stunning and slaughter on this fishery need to be investigated, and ice slurry should be tested as a slaughter procedure if adequate stunning is previously employed.

Hooking effects on immediate and post-release welfare and subsequent mortality of an important marine recreational fishing target species in Portugal-the common two-banded seabream *Diplodus vulgaris*

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Abstract content: Recreational fishing employs several methods of capture, but the most widely used is angling. At many fishing events, a portion of the catch is returned to the sea, either because it is not desired or due to the principle-based practice of catch and release (C&R). C&R is a controversial strategy, triggering a significant debate on welfare issues. Angling involves actions such as hooking, pulling the fish towards the surface, and handling, which can cause physical injuries and physiological disorders with short-and long-term sublethal impacts, or ultimately result in delayed mortality. Also, where there is no immediately related C&R mortality, fish can experience further sublethal effects, such as behavioral changes, decreased growth, and reduced reproductive success. In this study, hooking mortality and sub-lethal effects of C&R were tested through a series of experiments. A preliminary experiment was carried out at sea, simulating a recreational onboard fishing event with multiple anglers. The study targeted wild common two-banded sea bream, a primary species caught by angling in Portugal. A total of 21 fish were captured, with data recorded on hook type, fighting duration, hook placement, and fish size. The fish were tagged, and blood samples were taken from 8 fish before being released into cages equipped with underwater cameras to monitor behavior. After 4 hours fish in cage appeared calm, with normal swimming and no evident attemps to escape. At this point fish were swiftly recovered from the cage and deeply anesthetized and blood samples were collected from all fish. One fish died within 30 min of being caught, with the hook lodged in the liver. Among the captured fish, 76% were caught with larger hooks, and 23% swallowed the hook. Glucose and lactate levels were analyzed. While glucose showed a slight increase between the time immediately post-fishing and after the 4-hour interval, lactate was over 6-times higher after the simulated C&R event, likely indicating anaerobic exercise, not observed while in cage and attributed to the fishing and handling process. The outcomes of these experiments provide critical insights into the impacts of angling on fish health and welfare, offering a baseline for more sustainable and ethical fishing practices.

Evaluation of illegal transport effects on confiscated glass eel (*Anguilla anguilla*)

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Abstract content: European eel is considered a “critically endangered” species due to its population decline (c.a. 98%) in all European waters, primarily because human activities. The eel life cycle is very complex as it includes long migrations, and although aquaculture can help in repopulation, at this time artificially raised eel larvae has little survival. Therefore, to reverse this situation, in 2007 the EU adopted the Eel Regulation, starting a series of plans in the following years to improve the conservation and the recovery of the eel population, which included a ban on importing and exporting eels in all EU countries. However, an illegal global market and food fraud developed as populations declined and plans were adopted to counter it, turning Europe into the source of the international illegal eel trade. This study reports the evaluation of the welfare consequences (at stress and defensive capacity levels) of the illegal transport method using European eel mucus, one of the most promising tools for studying endangered fish species. We also aimed to determine the rehabilitation time required in controlled conditions before their release to the Ebro River. Glass eels (0.29 ± 0.06 g / fish; total of c.a. 30 kg) arrived in November 2022 at the IRTA’s facilities and were maintained in open water tanks until March 2023. The results showed that despite the measures taken to keep the eels alive during transport, high metabolite and cortisol levels were observed in mucus. In addition, the defensive capacity against possible bacterial infections was also affected due to the transport conditions as bacterial co-culture with mucus analysis indicated. Regarding the rehabilitation time, we analysed the same parameters as for the initial transport point resulting in a stabilisation of stress parameters and an increased defensive capacity from day 3 to the final release, but the best results were observed after 1 month of rehabilitation. These findings suggest that the transport stress is critical for the survival of glass eels, as only two-thirds of the initial eel survived, and the stress and defensive capacities analysis suggest a minimum of 1 month recovery period before the release.

Effects of acetic acid administration in the lips of gilthead seabream (*Sparus aurata*): Establishing a pain model for teleosts

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Abstract content: Pain is an unpleasant sensory and emotional (subjective) experience associated with actual or potential tissue damage. In fish, electrophysiological and neuroanatomical studies found that nociceptors (pain receptors) accumulate predominantly in the lips. Therefore, the aim of this study was to evaluate the behaviour of gilthead seabream (*Sparus aurata*) specimens after subcutaneous injection of acetic acid (AA) in the lips. Forty seabreams (60g mean weight) were individually placed in tanks and were recorded for a period of 30 min. The fish were then sedated and injected subcutaneously in the lips (sham group), with PBS (control group), 1%, 5% or 10 % of AA. The fish were recorded again for 15 min periods at 0.5, 1.5, 3 and 6 h after injection, and potential alterations in fish behaviour were analysed with BORIS software (Version 8.21) in a blinded test. The results revealed that the sham and control fish showed no variation in any of the parameters studied over time. However, fish injected with 10% AA showed a decrease in the time spent active at 0.5, 1.5 and 3 h compared to the rest of the experimental groups. In addition, fish injected with 10% AA decreased the time spent at the top and in the middle of the tank, but increased the time spent at the bottom at 0.5, 1.5 and 3 h post-injection compared to the sham and control groups. In terms of fish activity, individuals injected with the highest dose of AA decreased the number of times they moved to the top of the tank at all experimental times. Our results suggest that AA at a concentration of 10% can produce pain in seabream, which can be used as a model to study nociceptive mechanisms. In addition, these data can be used to promote greater awareness in the aquaculture industry about fish welfare in production.

Can fish talk to each other? First attempts assessing sounds from Mediterranean freshwater fish, and invasive fish species!

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Abstract content: Fish use a variety of sensory systems to learn about their environment and to communicate. Of the various senses, and although it is not their primary ability, hearing plays a particularly important role for fish in providing information from all around them, often at great distances. This information is in all three spatial dimensions, often overcoming the limitations of other senses such as sight, touch, taste and smell. Sound can be used for communication between fish, mating behavior, detection of prey and predators, orientation and migration, and even habitat selection. However, very little is known about the ability of teleosts to produce sound, especially in freshwater fish. With this premise in mind, this study has attempted to identify the possible sound of several native species of Mediterranean waters (rivers and marshes) and several invasive fish species (IFS) in the Mediterranean region.

To carry out the experiments, 6 native species (*V. hispanica, A. iberus, G. aculeatus, S. fluviatilis, L. guiraonis* and *S. valentinus*) and 5 IFS (*L. gibbosus, G. holbrooki, A. alburnus, M. salmoides* and *C. auratus*) were placed in a 150-litre aquarium, independently, for at least 24 hours (each species) with a 12:12 photoperiod. In addition, a hydrophone was placed in the aquarium to record any sounds emitted by the fish. We calculated the Sound Pressure Levels (SPL) in several one-third octave bands. The 125 Hz and 2000 Hz one-third octave bands allow us to identify the circadian rhythm of some species with higher SPL during the light periods. However, the circadian rhythms of some species (*G. aculeatus*) were clearer than those of others (*A. alburnus*). During the experiment, *A. iberus* showed the higher SPL in the one-third octave band at 125 Hz compared to the other species. Our hypothesis is that the increase in SPL is due to stridulation, and we are working on identifying the characteristic sound patterns of the different species. These preliminary results show the first sound recordings of some fish species, which could be used as a screening method (native species) or as an early detection technique for IFS in the Mediterranean region.

Assessing temporal changes in the structure and composition of fish assemblages of the Mar Menor in response to critical eutrophic-mediated events

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Abstract content: During the last decades, the Mar Menor coastal lagoon (southeast Iberian Peninsula) has suffered a drastic process of eutrophication derived from the input of inland nutrients associated with urban development and the expansion of intensive farming practices. This situation has recurrently triggered critical eutrophic events, such as algal blooms, loss of seagrass meadows or mass mortality of marine fauna. In this study, we explore different approaches on how these critical events have affected the structure and composition of fish assemblages in the shallow areas of the lagoon. For this purpose, we assessed changes in the structure and composition of the fish community between a reference period (2002-2004) and two subsequent periods characterized by stress conditions: a first critical eutrophic period (2018-2019) and a second critical eutrophic period with multispecies mass mortality events (2020-2021). Major changes in abundance and biomass values were explained by the seasonal factor, although usually higher values of these metrics were also observed in the reference period as compared to both eutrophic periods. Likewise, analyses of beta diversity showed similar results for the periods studied, with minor fluctuations in the indices of richness difference, similarity and replacement. Seasonally, richness differences among sampling sites increased during the autumn of both periods subjected to critical events, thus decreasing the similarity of their assemblages. On the other hand, major changes in community composition reflected shifts in species dominance and representativeness, with effects being apparent at community structure. We also detected a positive and combined response of a pool of fish species to algal blooms and loss of seagrass meadows in the deeper areas. Conversely, representativeness of benthic species not closely associated with shallow areas increased immediately before and after mass mortality events. However, these changes were not so evident at trophic and estuarine-use level when we analysed from a guild perspective. Nevertheless, major composition-related changes indicate a decreased fish community integrity in Mar Menor shallow areas and could act as indirect evidence of its stability and functionality within the ecosystem. Part of this research was supported by the Environmental Service and Mar Menor Service of the Autonomous Government of Murcia (Spain).

Syngnathids of Mar Menor shallow areas (Western Mediterranean Sea): habitat relationships at two spatial scales and their role as a surrogate family

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Abstract content: Syngnathid fishes are a vulnerable family closely associated with vegetated bottoms. Despite being charismatic, several basic aspects of their life cycle and population ecology remain still unexplored. This study aims to investigate species-specific, ontogenic and spatiotemporal differences in habitat selection (microhabitat and seascape scale) of the syngnathid assemblage of the Mar Menor shallow areas as well as the role of this family as surrogate of estuarine fish diversity. This lagoon serves as a paradigmatic example of a hypersaline eutrophicated ecosystem, which has recently experienced seagrass mortality in deeper waters. The syngnathid assemblage in our study area was formed only by three representative species: *Hippocampus guttulatus*, *Syngnathus typhle*, and *Syngnathus abaster*, with the latter species exhibiting a clear dominance. Juvenile stages were particularly important in shallow areas, especially for *H. guttulatus*, which has experienced a significant decline in recent times. The limited recruitment rates highlight the significance of shallow areas for the conservation of this threatened species at a lagoon context. Our findings also revealed species-specific and ontogenetic differences in habitat selection, with the seascape structure playing a crucial role at all developmental stages. Currently, the occurrence of *H. guttulatus* juveniles appears to be influenced by water quality parameters, particularly in areas with higher water renewal rates (i.e. close to channels connecting Mar Menor with the Mediterranean Sea). Conversely, the other two pipefish species exhibited a clear relationship with vegetation parameters, which were more relevant during the adult stages. Specifically, *S. typhle* adults preferred extensive covers with long leaves, while adults of *S. abaster* selected extensive meadows with high vegetation densities. The macrohabitat scale was more important for adults in *S. typhle* and for juveniles in *S. abaster*. Lastly, *S. abaster* emerged as a surrogate species as the abundance of its life stages was correlated to different community parameters as a function of season. These results can become key for informing future syngnathid management strategies and assisting estuarine fish monitoring programs. Part of this research was supported by the Environmental and Mar Menor Service of the Government of the Autonomous Community of Murcia (Spain).

Feeding success of the declining population of long-snouted seahorse (*Hippocampus guttulatus*) under habitat loss

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Abstract content: Seahorse populations in the Ria Formosa lagoon have drastically decreased by 90% over the last 20 years. They are facing illegal fishing and habitat degradation, particularly seagrass loss and more recently the rapid spread of a non-native seaweed, *Caulerpa prolifera*. Understanding the factors mediating the feeding success of seahorses when facing habitat changes is vital for targeting the urgent conservation efforts of these threatened populations. We conducted four sequential experiments to investigate how prey identity (amphipods and shrimps), prey availability and habitat complexity affected the prey capture efficiency of the long-snouted seahorse (*Hippocampus guttulatus*) in the three subtidal habitats of the lagoon: (i) the native seagrass meadows, (ii) unvegetated sediments, and (iii) the non-native *C. prolifera* meadows. Results revealed a great adaptability of *H. guttulatus* to all habitats, as habitat type did not significantly affect the feeding success regardless prey type or prey availability. We also found that high vegetation complexity, at both seagrass and habitats with *C. prolifera*, enhanced the prey capture efficiency. The response of seahorses to complexity loss in vegetated habitats help to understand the decline of their populations in the face of human-induced disturbances causing the regression of seagrass meadows and may have important implications regarding the resilience and conservation of these threatened populations. We found no evidence of a negative impact of *C. prolifera* spread in the feeding success of *H. guttulatus*. However, more research is needed to understand the main causes of population decline of seahorse populations, particularly in the face of global change impacts.

Presence of blackchin guitarfish (*Glaucostegus cemiculus*) in waters of Doñana National Park (Spain, North East Atlantic)

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Abstract content: The Iberian Peninsula holds the highest diversity on elasmobranch (skates, rays and sharks) species of all the European region, even though having suffered several local extinctions, mostly of large benthic coastal species. One of those species is the 'guitarrón' or blackchin guitarfish (*Glaucostegus cemiculus*), whose historical range in the Peninsula covered the mediterranean coasts and the southern Atlantic coasts. Here we report for the first time the presence of blackchin guitarfish within the protected waters of Doñana National Park in Huelva, Spain. These records confirmed previous non-published reports by researchers and data collected through the Mediterranean Elasmobranchs Citizen Observations (MECO) project. This could be the first insight of a stable population and a possible nursery area, a very important stronghold given its disappearing from other areas of the Peninsula. Sampling was conducted in coastal shallow areas from Matalascañas to Guadalquivir river's mouth (Sanlúcar de Barrameda) over a five-day period. A total of 14 specimens were observed characterized by a population structure of 5 juveniles and 9 adults or subadults. Furthermore, we confirmed accidental catches by recreational and professional fishermen through interviews. A more serious threat emerged with the consumption of this protected species by the local population, a fact demonstrated through the interviews but also with the discovery of four severed heads on the beach itself, evidencing cases of poaching within Doñana's marine protected area. The results of this study can foster other large studies in this area, through the creation of a catch and release program and the obtention of DNA samples. Further collaborations on these efforts are welcomed.

Short and long-term temperature variations drive recruitment variability in marine and estuarine juvenile fishes

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Abstract content: Understanding the long-term effects of climatic factors on key species' recruitment is crucial for species and ecosystem management and conservation. This work aimed to analyse the variability of recruitment of five key species: *Dicentrarchus labrax, Platichthys flesus, Solae solea, Pomatoschistus microps* and *Pomatoschistus minutus* in a temperate estuary and to relate this variability to the prevailing local and large-scale environmental factors, using a 17 years time series (from 2003 to 2019). Using a dynamic factor analysis (DFA), juvenile abundance data were clustered into three common trends linked to different habitat use and life cycle characteristics (e.g., resident species vs marine juvenile migrants), and the best model included a significant effect of temperature-related variables on fish recruitment: the Sea surface temperature and the Atlantic Multidecadal Oscillation. In 2010, a regime shift in the North Atlantic coincided with a shift in the three common trends, particularly evidenced by a decline in the one most associated to the flatfishes *P. flesus* and *S. solea*, matching recent warming trends in the NE Atlantic. This study highlights the thermophilic character of fish recruitment and the necessity to investigate key biological processes in the context of species-specific responses to climate change.

Criteria for the delimitation of brown trout waters based on temperature regimes to improve fishing regulations and management

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Abstract content: Temperature acts as a critical factor in shaping the distribution of freshwater fishes. Each species possesses a specific thermal niche, which is the optimal temperature range necessary for its successful development, reproduction, and overall survival. For the brown trout (*Salmo trutta*), the only native salmonid species in Catalonia, the key factor in identifying suitable habitat zones is the presence of maximum water temperature isotherms of 20-21ºC during July. Climate change poses a significant threat to the brown trout, one of the species predicted to suffer from rising water temperatures. As temperatures increase, suitable habitats will likely become increasingly limited to headwater areas with sufficiently cold water. Consequently, the distribution of brown trout is expected to shift over time, and because of this, a review of the boundaries of brown trout waters in Catalonia was performed in 2018. This updated information was used to refine both the designated continental fishing zones and the seasonal closure of the fisheries to protect fish during a vulnerable part of their life cycle such as spawning. These modifications enable improved management practices, ensuring better protection of brown trout populations in Catalan waters. To improve the quality of the temperature data on which the criteria are based, a water temperature monitoring network was implemented in 2022 within several sections of the Ter basin, with plans to expand throughout Catalonia. This network utilizes data loggers to continuously record water temperatures, providing significantly more accurate data than previous extrapolation methods. Currently, 17 data loggers are installed in the Ter, Freser, Osor, and Major rivers. Optimal consistency in results will emerge after three years of continuous monitoring. While the network's primary focus is brown trout, the collected data has broader applications for the management of other native species.

An updated check-list of the ichthyofauna of the inland waters of Morocco

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Abstract content: Morocco, with its privileged geographical position, is characterized by high levels of fish endemism due to the number of wetlands and a hydrographic network spanning 2,000 km of waterways that offer a rich habitat diversity for its continental ichtyofauna. The present paper represents a unique review synthesis on the continental ichthyofauna of Morocco, which currently comprises 77 fish species representing 21 families, and is made up of 26 alien species (33.7%) and 51 native species (66.2%, of which 21 species are endemic). The Cyprinidae family has the highest number of species, 29 species (37.6% of the total), followed by Salmonidae with 8 species (10.4%), Mugilidae, Cichlidae and Centrarchidae with 5 species each (6.5%), Cyprinodontidae, Clupeidae with 3 species each (3.9%), Moronidae, Gobiidae, Poeciliidae, Acipenseridae and Percidae with 2 species each (2.6%). The last families, Anguiliidae, Atherinidae, Cobitidae, Blenniidae, Esocidae, Pleuronictidae, Petromyzontidae, Ictaluridae and Syngnathidae only account for one species (1.3%). According to IUCN Red List criteria, out of the 51 native species naturally distributed in Moroccan continental waters,seven species (13.7%) are extinct (EX), while 16 species (31.4%) are classified as threatened. Among the threatened species, four are categorized as CR (7.8%), seven (13.7%) as EN and five (9.8%) as VU; two taxa are classified as NT (3.9%), 23 species as LC (45.1%), and three species (5.9%) were classified as DD due to limited knowledge. The current situation of the Moroccan ichthyofauna is fragile and vulnerable to climate change including severe droughts, and the destruction of natural environments. Demographic pressure, pollution, the introduction of alien species and overfishing are other threats affecting Moroccan ichthyofauna. Therefore, it is necessary to implement necessary measures and appropriate policies aimed at preserving and protecting the diversity of Morocco's inland fish fauna, ensuring its sustainable conservation.

Fish microhabitat use upstream and downstream from small hydropower plants

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Abstract content: Hydropower can severely impact river ecosystems due to the occurrence of hydropeaking (i.e., artificial rapid and short-term fluctuations in water flow and water levels downstream of hydropower stations) that negatively affect downstream fish. However, when it comes to analysing the effect of the presence of small hydropower plants (SHPP) on species habitat use and availability, studies conducted at the microhabitat scale are scarcer. The study aimed to assess the microhabitat use by native fish above and below SHPPs, partitioned by season (early and late summer) and ontogeny (juveniles and adults). Fish were surveyed by point electrofishing sampling, and a multivariate approach was used to analyze microhabitat use and availability data from sites located upstream (reference) and downstream (disturbed by induced peak-operations) from 2 SHPP in NE Portugal. Cover and depth were the most important environmental variables in the use of microhabitat for all species at both the reference and disturbed sites. Leuciscids exhibited similar patterns of non-random (i.e. selective) microhabitat use between the reference and the disturbed sites. Overall, seasonal and size-related patterns in species microhabitat use were similar between the reference and disturbed sites, with most of the species displaying seasonal patterns in microhabitats use from early-summer to late-summer. The results of this study showed that differences in fish microhabitat use between downstream SHPP and upstream reference sites were negligible. Cover might have had an influential role in attenuating the effects of detrimental environmental conditions, namely, peaking flows, by providing hydraulic shelter, highlighting the need to maintain riparian vegetation strips and mosaics of submerged aquatic macrophytes, as well as the provision of coarse substrata that can be critical for fish.

Trophic ecology of fish species in Iberian lakes: preliminary results from a long-term sampling campaign in aquatic food webs

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Abstract content: Understanding the structure and functioning of food webs is one of the most challenging tasks in trophic ecology, particularly in the context of global change. Lakes constitute a small portion of the total Earth's surface, but they serve as biodiversity hotspots and provide numerous ecosystem services. Food webs in lakes are particularly sensitive to global change factors because the impacts on one trophic level can drive cascading effects altering key ecosystem processes like energy fluxes, which are often remaining unknown due to the lack of empirical data. We present preliminary results on the structure and functioning of food webs in Iberian lakes after two intensive sampling campaigns conducted in 2022 and 2023. In a comparative approach between two nearby lakes in the Gredos mountains, the non-native brook trout *Salvelinus fontinalis* (Mitchill, 1814) inhabiting the lake Cimera showed a broader niche (both isotopic and stomach contents), higher reliance on terrestrial food resources, higher $\chi^{13}C$ values and higher trophic position than the native brown trout *Salmo trutta* L., 1758 inhabiting the lake Grande. Furthermore, we observed for the first time the outstanding feeding of northern Iberian chub *Squalius carolitertii* (Doadrio, 1988) on micromammals and fish, indicating that the fish species is primarily omnivore, but some individuals can become apex predators. Finally, we will also show some explorative analyses of the body size structure, stomach contents, and isotope analyses of the main trophic levels in lake food webs. The study will continue over the next years, covering large spatiotemporal gradients and different human-induced impacts including habitat fragmentation, eutrophication, and biological invasions. Long-term research in lakes can help to understand the effects of global change factors on food webs and provide valuable insights for stakeholders and contribute to management decisions regarding the ecological status of freshwater ecosystems.

Predatory pressure of *Silurus glanis* on native fauna in the Tagus River basin

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Abstract content: The European catfish, *Silurus glanis*, is a large apex predator, with up to 2.7 m and 130 kg, that has recently been established in the Iberian Peninsula. Given their large body size coupled with their capacity to reach high densities, catfish can cause severe predatory pressure on recipient communities. In Iberian streams, native fish species are mostly non-predatory, making them more susceptible to larger invasive predators. This is especially concerning, given that Iberian ichthyofauna consists largely of endemic, often endangered, species. A previous preliminary study, in the Tagus River, pointed to crustaceans as their main prey but observed some predation occurring on fish as well. Considering the study's limited sample size, it is important to understand to what extent catfish are predating on native fauna, especially on lotic systems. In this work, we investigated the diet of the European catfish by examining the stomach contents of 491 individuals from lentic (206) and lotic (285) habitats in the Tagus River. Diet analysis included prey richness, composition and abundance, and biomass, throughout seasons and ontogeny (using total length and dimensional classes: < 50 cm; 50-100 cm; > 100 cm). In lentic habitats, *Procambarus clarkii* emerged as the main prey in both abundance (29%) and biomass (30%) irrespective of predator size, and in all seasons. In lotic habitats, more native fish prey were detected (eight vs one, respectively), with endangered migratory fish like sea lamprey, shads, and eels, being detected in relatively high abundance and biomass (24%), primarily in Spring. Eels were found mostly in smaller individuals while other common prey were found mostly in larger individuals. This study offers detailed insight into the diet patterns of the European catfish throughout different habitats, seasons, and ontogeny. It represents the first robust empirical evidence of widespread predation on migratory species with great conservation and commercial value. These results support and may facilitate the management of *Silurus glanis,* especially when considering fishermen's activity which is for the most part focused on Spring: the migratory species time.

Fish larvae biodiversity of the Azores Islands-a morphological and molecular analysis

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Abstract content: Oceanic islands have a well-established role in fisheries production as key habitats for marine fish larvae, providing suitable conditions for their development and growth. In these areas, larval fish assemblages are mainly influenced by local topography and water circulation, which drives their retention and dispersal pathways. Dispersal and connectivity among life stages and geographical areas are key characteristics of marine organisms, as they determine population dynamics, habitat colonization patterns and resilience to harvest. Knowledge of these processes is fundamental for developing management plans. The Azores archipelago (Portugal) is located in the northeast Atlantic, with four islands classified as UNESCO Biosphere Reserves. This marine wildlife hotspot supports important fisheries but studies focusing on fish larval assemblages are scarce and dated. This limitation may stem from the challenging task of morphological identification of fish larvae, which requires a high level of expertise. However, genetic markers have proven to be a powerful tool for the accurate identification of fish larvae. In this study, we characterized the composition, spatial distribution, and the influence of environmental factors on the spring-early summer larval fish communities in the Azores, integrating both morphological and molecular identification techniques. Specifically, we used two genetic markers, COI and Mi Fish. A high diversity of species was found (36 species) with the most representative families being Blenniidae, Pomacentridae, Labridae, Scombridae, and Myctophidae. The islands from the eastern group (Corvo and Flores) exhibited a higher species abundance and diversity compared to those in the central group (São Jorge and Graciosa). Species diversity and abundance appears to be linked to local environmental factors such as water temperature. Morphological techniques when used alongside with molecular tools provide a more accurate identification, especially for disentangling some challenging species identifications. Facing ocean-wide changes on biodiversity and functional connectivity due to global warming, studies focusing on ichthyoplankton provide a relatively cost-effective and efficient way to monitor ecosystem functioning, contributing to the effective management of marine ecosystems and fisheries.

Is the population of *Myloplus tiete*, a native and threatened species, made up of specialist individuals?

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Abstract content: Populations with generalist feeding habits may consist of specialist individuals or be composed of specialist individuals, consuming subsets of the population's diet, thus favoring population stability. Therefore, knowledge of inter-individual variation and individual diet specialization contributes to understanding ecological interactions and population maintenance, especially when evaluating a native and endangered species such as *Myloplus tiete*. Thus, we tested whether there is inter-individual variation and individual specialization in the diet of *M. tiete* in the Paraná River, Jupiá Reservoir, SP. Thirty specimens were collected by anglers (hook and line) in March 2023, and their stomach contents were identified, quantified, and presented in volumetric percentages. The inter-individual variation was calculated using the *E* index, and the individual specialization was assessed using the *V* metric. Individuals of *M. tiete* consumed 13 food items, in addition to corn and soy (provided by fishermen), with *Egeria* sp. (59%) and grasses (26%) being prominent, thus characterizing the species as a generalist herbivore. Low inter-individual variation (E=0.32) and low individual specialization (V=0.2) were observed. Despite consuming various resources, generalist species can also exhibit low individual variation when a large subset of the population consumes a wide variety of these resources. Previous studies characterized *M. tiete* as herbivorous, suggesting potential variation in plant resource utilization among individuals. Contrary to the predictions, there was a predominance of generalist individuals. Considering that an individual specialization in generalist species may be related to a high individual variation in diet resulting from each individual's exploitation of specific food resources, we infer that food items were consumed similarly by all individuals of the species. Therefore, individual generalism may be related to the high food availability in the environment, supported by the high abundance of the most consumed items. Such behavior, along with trophic plasticity, may contribute to population maintenance/stability in response to changes in food resources.

Estuarine use rather than trophic functional guilds are better predictors of the processes underlying fish community structure in a tropical coastal lagoon

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Abstract content: The influence of environmental factors on fish communities is well known. However, spatial structures may also contribute to the patterns observed within some communities. These structures can arise from either the spatial structure of environmental factors (*i.e.*, induced spatial dependence) or internal processes within the community itself (*i.e.*, spatial autocorrelation). Fish are differently influenced by environment and space, depending on their attributes. Based on these attributes, which can include trophic level and use of the environment, they can be grouped into guilds. The guild classification approach provides a better understanding of the ecology and the role of the biota within an ecosystem. Particularly, estuarine use (EUFG) and trophic (TFG) functional guilds have proven to be valuable tools in comprehending the structure and functioning of several aquatic ecosystems. Despite their widespread application, the sensitivity of functional guilds to ecological processes is barely known, and it is unclear which one is the most suitable predictor of these processes. Our aim was to explore the sensitivity of EUFGs and TFGs to environment and space and discriminate between the effects of spatial autocorrelation and induced spatial dependence within the community. Given the strong link between environmental conditions and community assembly in coastal lagoons, we hypothesized that EUFGs, rather than TFGs, would display higher sensitivity to environmental changes and perform better as predictors of environmental and spatial processes. We applied two redundancy analyses (RDAs) to investigate the relationship between environmental and spatial predictors with (1) the abundance of EUFGs and (2) the biomass of TFGs, which explained 41% and 31.8% of the variation, respectively. We used a variance partitioning analyses to discriminate between environmental or spatial processes, which revealed that purely environmental variables and induced spatial dependence explained a larger proportion of the variation in EUFGs (21% and 11%, respectively) compared to TFGs (17% and 7%, respectively). Spatial autocorrelation equally explained the variation in both guilds (6% each). Our findings showed that EUFGs slightly outperformed TFGs as predictors of both environmental and spatial processes, suggesting that EUFGs might offer more nuanced insights into the processes underlying fish community structure in coastal lagoons.

High spatial variability in the density of cavilat (*Cottus hispaniolensis*) in the Garonne River

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Abstract content: Understanding why a species is present and abundant in a specific location is essential to identifying the mechanisms that maintain ecological diversity. The cavilat (*Cottus hispaniolensis*) in the Garonne River basin in the Aran Valley has experienced a strong regression during the last decades due to habitat alterations. Additionally, the exceptional flood of 2013 caused a further decline in cavilat populations. Current and historical data described a discontinuous distribution along the Garonne River. The cavilat can be either very abundant or non-present in nearby localities, which raises questions about population fragmentation and the habitat factors influencing its distribution and abundance. To address these questions, we quantified several abiotic factors that may affect the cavilat distribution and tested their influence on fish density. The study reach included the Garonne River between Vielha and the French border. Given the logistical challenges of sampling a large stretch of the river, an efficient methodology was employed. This involved single-pass electrofishing to sample the wadeable part of the river along one bank.

A total of 27.2 km of river were surveyed, divided into 95 sections with an average length of 286.8 m. The mean estimated density per section was 2.3 ind/100 m (S.D: 3.3 ind/100 m) but was extremely variable, from zero (non-present) to 20 ind/100m. The cavilat's spatial distribution is considered overdispersed or patchy because the variance is greater than the mean. The 2013 flood could have been responsible for this patchy distribution but the data before 2013 are also consistent with this pattern, indicating that other factors are involved. Cavilat density was positively correlated with river slope and negatively with mean current velocity, which suggests that small-scale variations in habitat factors may explain its distribution and abundance. However, the relatively large unexplained variance emphasizes the need to investigate other factors such as biotic interactions or individual movement rates. Knowing how the cavilat is distributed along the river channel has important implications for the conservation of the species.

Determining the role of mesohabitats and seasonality on the native species *Barbus meridionalis* fish population size structure: Case of study of the Ter River (NE Catalonia)

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Abstract content: Spatial diversity patterns of stream fish communities are broadly defined along the downstream-upstream gradients, but less is known about the fish habitat distributions at a mesoscale. Mesohabitats are defined as small spatial units within a stream reach and can be key to help establishing conservation measures for threatened fish species. Given that stream structure offers numerous mesohabitat opportunities, stream fish species can be spatially distributed due to habitat conditions and biotic interactions.

The objective of this study was to assess the role of mesohabitats and seasonality in the spatial distribution of the native fish species Mediterranean barbel (*Barbus meridionalis)* in a Ter River stretch, where systematic electrofishing surveys were conducted seasonally along 2022. We assessed how population abundance, and body size structure of *B. meridionalis* responds to prey resources, non-native fish species, and environmental conditions. We hypothesize that *B. meridionalis* at different life stages would use differently the sampled mesohabitats along seasons to avoid intraspecific competition.

The poster will offer preliminary results of the main drivers affecting the spatial distribution of *B. meridionalis* at a mesoscale. We will propose future directions of research based on data modelling, and we highlight the use of mesohabitats for the potential application on river restoration.

No water, no problem! Adaptive plasticity of non-annual killifish (*Cyprinodon variegatus*) embryos to drying out conditions

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Abstract content: Spontaneous and reversible arrest at certain embryonic stages is a normal aspect of the life cycle in a wide range of vertebrates and invertebrates, and one group of these organisms are the so-called annual fish. The complete drying out of this habitat leads to the death of all adult fish, while embryos may undergo up to three consecutive periods of diapause (developmental arrest) for weeks, months, or years. On the other hand, the order Cyprinodontiformes also includes non-annual fish, in which diapause apparently does not occur, but a short-term delay or postponement of hatching has been described with variable temporal frequency in some species. Thus, the aim of this study was to assess whether the model species *Cyprinodon variegatus*, belonging to non-annual killifish, exhibited this biological arrest at the embryonic stage. Embryos of *C. variegatus* collected from different batches were placed in 60-mm Petri dishes and incubated on air (out of water) on two different substrates (soil and sand) for 7, 11, and 14 days, and subsequently transferred to seawater. The dishes maintain ~100% of relative humidity (RH) and were incubated in darkness at room temperature (20°C). During the experiment, newly hatched fry and dead embryos were recorded daily and removed. Mortality was monitored until 100% hatching. Data collected showed that after 7 days of air exposure, about 80% of embryos incubated both in soil and sand substrate were able to continue their development and hatching into a healthy larva. However, after 11 days of air exposure, the hatching rates of the eggs incubated in both substrates decreased by up to 50-60%. Finally, after 14 days of air exposure, the hatching rates of the eggs incubated in air exposure decreased to 30%. The results of this study indicate by the first time that *C. variegatus* embryos have the plasticity to reach the pre-hatching stage failed to hatch, remaining within the intact chorion for periods of until 14 days. These preliminary studies pave the way for further research into embryo arrest, starting with a detailed analysis of the molecular keys to this process and how this mechanism relates to critical events such as climate change.

Comparing benthic fish assemblages in shallow and deep waters of the Mar Menor coastal lagoon

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Abstract content: Recurrent eutrophic events have recently affected the Mar Menor coastal lagoon and impacted on the structure of estuarine biotas and characteristics of submerged habitats. Bottom parts have been more strongly affected from eutrophication, where recurrent hypoxia events have been also reported. This scenario could have compromised the population viability of benthic fish communities inhabiting the Mar Menor coastal lagoon. The main goal of this study was to assess the current situation of benthic fish communities of the Mar Menor in different habitat types and areas with contrasting water depth. Fish communities of shallow waters (<2m) were surveyed with a beach seine net, whereas those from deeper areas were studied with a lightweight epibenthic trawl towed from boat. Benthic fish communities associated to seagrass habitats and unvegetated bottoms showed a high species dissimilarity from each other, regardless of depth values. Fish assemblages recorded at deeper areas were highly simplified and homogeneous, likely due to the habitat homogeneity promoted by the dominance of *Caulerpa prolifera* monospecific beds. In contrast, shallow waters showed higher habitat heterogeneity (monospecific meadows of *Cymodocea nodosa* and *C. prolifera*, mixed meadows or unvegetated habitats), which promoted a greater species diversity in their fish assemblages. Lack of previous data on benthic fish communities from deep waters of the Mar Menor precludes a comprehensive assessment of impacts from recent eutrophic events. Therefore, these results represent a first preliminary assessment of benthic fish assemblages associated to Mar Menor deep waters and a starting point for future studies. Part of this research was supported by the Environmental Service and Mar Menor Service of the Autonomous Government of Murcia (Spain).

Variation in the fish association of the Zahara-El Gastor reservoir 20 years after its construction

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Abstract content: The Zahara-El Gastor reservoir (Cádiz, Spain) is not only relevant for its recreational services, being a major tourist attraction in the region, but it also plays an important role in the water regulation of the Guadalete River as it serves as a headwater reservoir collecting water from the area with the highest average rainfall in the country. We documented the transition of the water body from a lotic to a lentic environment, as well as the temporal dynamics of fish community composition in the early years of the reservoir's existence. After 20 years, a new study has been conducted on this ecosystem. Four sampling campaigns were carried out (spring, summer, fall, and winter), using both direct sampling (fishing gear) and indirect sampling (hydroacoustic techniques). The fishing gear used included trammel nets, multi-mesh gillnets, and traps along the shores. For the acoustic sampling, a scientific echosounder model SIMRAD EK60 was used, applied both vertically and horizontally. Nowadays, the fish composition in the reservoir is dominated by the non-native species, with bleak (*Alburnus alburnus*) being the most abundant. However, the Iberian nase (*Pseudochondrostoma willkommi*), a native species that was once predominant in the past, has practically disappeared. Similarly, there has been a drastic decline in the fish population of the barbel (*Luciobarbus sclateri*), which was the second most abundant native species. The spatial-temporal heterogeneity in the distribution of the fish community observed before the creation of the reservoir, mainly due to the migratory processes of the Iberian nase and the barbel, has disappeared. Currently, there is a homogeneous distribution with no significant changes in fish density over time (seasonal cycle) or space (dam-to-tail axis). The only differences recorded are associated with the processes of water column mixing and stratification, affecting the fish density observed in the bathymetric axis. The results obtained highlight the profound compositional changes in the fish fauna of the reservoir. These changes underscore the deterioration over time and the loss of ecological quality in this emblematic location.

Clinal geographical variations of life-history traits in Galician Sea Trout (*Salmo trutta* Linné, 1758) populations

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Abstract content: We have conducted a comparative analysis of some key biological traits in nine Galician sea trout (*Salmo trutta* Linné, 1758) populations located between latitudes 41.5º and 43.5º N.

These populations have been monitored over the last twenty years, obtaining data and samples both from several river traps and from official sport fishing records. Our analysis focused on several key life history characteristics [Age at smolt migration (MSA), Mean maiden age (MMA), Mean spawning frequency (MSF), Mean adult age (MAA) and Mean total age (MTA)], as well as fish growth in freshwater and sea. The analysis revealed notable differences between northern (Rías Altas) and southern (Rías Bajas) populations, while in the populations of the rivers located in between, the values of these characteristics were intermediate. Thus, the northern populations exhibit slower growth rates in both river and sea environments, delaying river departure (MSA= 2.64-2.70) and prolonging sea residency (MMA= 0.49-0.70). They also reproduce more frequently (MSF= 0.36-047), resulting in increased longevity (MTA= 3.07-3.87). Conversely, southern stocks show a higher river growth, leaving the rivers at a younger age (MSA= 2.04-2.38), and faster marine growth, leading to earlier reproduction (MMA= 0.26-0.53), with reduced spawning frequency (MSF= 0.16-0.30) and lower longevity (MTA= 2.73-2.83). Intermediate characteristics were observed in the populations living between these two areas (MSA= 2.20-2.39; MMA= 0.36-0.67; MSF= 0.46-0.67; MTA= 2.73-3.16). These findings suggest that local adaptations exist across the study area and illustrate geographic clinal variation within European sea trout populations. We suggest conducting continuous monitoring of the studied parameters in these populations to determine whether the detected variations could represent some type of population response to climate change.

Revealing ecological niches of *Luciobarbus* species in the western Iberian Peninsula and prospects for future translocations

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Abstract content: Understanding the ecological niche characteristics of species provides valuable knowledge into the mechanisms that drive species differentiation over space and time, which is especially valuable in the context of global changes. Range restricted species such as freshwater fishes from southwestern Europe may be particularly important for evaluating the ability of species to cope with climate changes. Here we examined barbels occurring in the western region of the Iberian Peninsula: *Luciobarbus bocagei*, *L. comizo* and *L. microcephalus*. The species *L. bocagei* and *L. comizo* are partially sympatric in the Tagus basin, while L. microcephalus distribution is nested within the southern distributional range of *L. comizo*. Species Distribution Models were employed to predict current distributions and future projections within and beyond their current distributional ranges. We used as predictive variables climate and hydro-topography datasets. We further evaluate niche properties, including niche breath and overlap. Overall, models performed excellently regarding predictive accuracy and discriminatory ability (AUC >0.9 for all species). Ecological niche properties revealed each barbel species have relatively broad niche breadth and high overlap. For the decade 2090s, *L. bocagei* future predictions include distributional area gains, except 1.7% loss under scenario SPP 5-8.5, and *L. microcephalus* predictions include losses only, from 76.3% to 93.3% under future scenarios SPP 1-2.6., SPP 2-4.5 and SPP 5-8.5. We discuss the adaptive potential of these species to future environments, particularly the risk of extinction of *L. microcephalus,* the accuracy of using such species as biotic indicators, and the potential risks associated with translocating *L. microcephalus* into new suitable areas.

The challenge of conserving the fish fauna in the current scenario of decreasing flows: the case of Daró River (Girona, Catalonia)

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Abstract content: The Daró River is one of the best-preserved Mediterranean rivers in northern Catalonia, at least along its upper course. Since its origin, it runs mainly through Mediterranean forest, with dense forest cover and almost total depopulation, to later penetrate little modified agroforestry landscapes. Overall, the pressures and impacts to which it is subjected are low, a fact that is reflected in a good general ecological state. The main factor of change in this river is clearly the progressive decrease in the average flow, a situation that can be attributed mainly to climate change.

On the other hand, populations of the four native species of fish potentially present are preserved in this river: eel (*Anguilla anguilla*), stickleback (*Gasterosteus aculeatus*), mediterranean barbel (*Barbus meridionalis*) and Catalan chub (*Squalius laietanus*). A single non-native fish species, pumkinseed (*Lepomis gibbosus*), is present but limited to a small sector.

We present and analyse the evolution of the flow of the Daró river from the end of the 20th century to the present. The decrease in the average flow has been evident. Even worse, the annual period of extreme low water, in which large sectors of the course of this river dry up, leaving only some flooded pools where the fish fauna resists, has been progressively lengthening. On the other hand, we present the results of our regular monitoring of fish populations, started in 2005, and carried out through the standardized use of fine-mesh (0.4cm) pot-type traps. The relative density (CPUE) of all fish species has notably and gradually decreased, as has the average and maximum size of some species, and even their occurrence.

Thus, the future scenario for the aquatic fauna of the Daró River is not very promising. If there are no changes in the observed trends, everything indicates that fish will disappear from this river over the next few decades, unfortunately. This situation can clearly be extrapolated to most Iberian Mediterranean rivers with similar characteristics. Some possible actions are proposed to mitigate, compensate, or at least delay this foreseeable and fatal outcome.

Evaluation of habitat for three native fish species in a section of the Júcar River under climate change scenarios

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Abstract content: Climate change influences the hydrosphere and biosphere at different spatial scales, including the basin scale. The exploration of such changes at the local level requires the implementation of a sequence of models encompassing different scales and under various scenarios. In this context, this study analysed the impact of climate change-induced hydrological changes on fish habitats in the middle part of the Júcar River Basin. For this, process-based computational models were applied to predict the river flows in Madrigueras (Albacete) under four climate change scenarios of the CMIP6 project (SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5), and in short (2022-2040), medium (2041-2070), and long-term (2071-2100) horizons. Considering those predicted flow time series, the hydraulic conditions were simulated using a one-dimensional hydraulic model. The habitat assessment was based on fuzzy rule-based models, which combine empirical data of hydraulic microhabitat preferences with expert knowledge. This chain of models allowed estimating ranges of change in habitat availability (in terms of Weighted Usable Area, WUA) induced by climate change for three fish species in different sizes: Eastern Iberian barbel (*Luciobarbus guiraonis)*, Júcar nase (*Parachondrostoma arrigonis)*, and Eastern Iberian chub (*Squalius valentinus)*. The hydrological model predicted a significant variation in future flows, in the range between +2.1 and +11.6%, -18.7 and -39.1%, and -8 and -73.5% (compared to the historical mean flow) in the short, medium and long term, respectively. Consequently, a decrease in the habitat suitability for fish is expected, varying between 20% and 82%, mainly depending on the scenario, species, and size considered. In addition, the predicted total time under habitat thresholds (30, 50% of the maximum WUA) and the continuous periods under a threshold would vary greatly. In summary, this study highlights the importance of coordinating hydrological, hydraulic, and habitat simulation approaches as effective tools for estimating the range of impacts of climate change, which managers should consider to plan their mitigation adequately.

New insights in Atlantic salmon conservation: genetic diversity and structure in northern Spain before the climate changed

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Abstract content: The Atlantic salmon *Salmo salar* stocks worldwide are currently overexploited and threatened by a multitude of human-induced pressures. These impacts have been more severe in southern Europe, where effective population sizes have been reported to be rather low and negatively affected by current climate change. Apart from the climate-driven ecosystem regime shifts leading to poorer trophic conditions that have occurred in their marine feeding habitats, the southern populations have experienced the most serious impacts in their environmental local conditions (mainly temperature and flow) of its entire distribution. Populations from northern Spain play a key role in conserving the species' original genetic diversity, which is endangered due to decades-long (1970's to 1990's) massive stocking with foreign specimens and a drastic reduction of population sizes from the 1980's onwards. To carefully assess the current conservation status of populations and to understand the effects of anthropogenic disturbances, climate-driven environmental changes, and conservation efforts, it is crucial to have an overview of the historical genetic diversity (before stocking and the severe impacts of climate change). Here, nine microsatellite loci were amplified from archival samples (scales from 1958-59) from eight Spanish rivers to analyse the species' natural genetic dynamics before its decline started. Allelic richness was high in historical populations (1950's) and above most contemporary estimates. Private alleles were found in most rivers, indicating high local uniqueness and relative isolation among river basins. Some of them are regional markers since they are rare or absent from contemporary northern European populations. Historical effective population size suggested a good conservation status, with higher values than those estimated for contemporary ones. Strong population structure and genetic differentiation between rivers were found, with limited gene flow, restricted to geographically close populations. In conclusion, extensive stocking with foreign specimens and ongoing climate change are responsible for the damage in the genome integrity of these rear-edge populations. Our estimates of historical genetic diversity and structure are a powerful benchmark to guide conservation programs.

Lipid content and fatty acid profile of round sardinella (*Sardinella aurita*): sustainable alternative in a warming NW Mediterranean

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Abstract content: Over the past few decades, due to sea warming driven by global climate change, the habitat range of round sardinella (*Sardinella aurita*) has expanded into the north-western Mediterranean Sea. This study evaluates the lipid content and fatty acid profile of this small, warm-water pelagic fish caught in this area, specifically the northern Catalan coast.

Small pelagic fishes, such as round sardinella, European sardine (*Sardina pilchardus*), and European anchovy (*Engraulis encrasicolus*), play a vital ecological role by transferring energy from phytoplankton to higher trophic levels. Evaluating the nutritional profile of these forage fishes serves as an indicator of the ecosystem health. It provides valuable insights into food web dynamics and trophic interactions, while also offering information about how changing environmental conditions impact the nutritional composition of these species and the phytoplankton upon which they depend.

Assessing the nutritional quality of recently established warm-water species in the northern Mediterranean is not only interesting for the knowledge of the trophic web but also serves as an environmental monitoring tool and supports sustainable fisheries management. Round sardinella, with its higher content of polyunsaturated fatty acids, emerges as a promising alternative for human consumption compared to sardine and anchovy. Encouraging the consumption of round sardinella not only offers significant nutritional benefits but also helps to alleviate the fishing pressure on sardine and anchovy populations, which are currently facing global change impacts.

Unlocking potential: Leveraging no-value bycatch species into new opportunities

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Abstract content: Fish is a crucial food source with considerable social and economic value for the world's population. With overfishing having increased in recent years, diversifying fisheries' target species might represent a solution for this global problem. No-value bycatch species, which represent a nuisance for fishers and administrative bodies, have the potential to become a new source of opportunities, and even income, for involved parts. In this regard, this study aimed to assess the potential of underexploited and underutilized fish species, by analysing the abundance, life-history parameters, nutritional and consumer-related aspects. From the two non-commercial and discarded fish species that were analysed, our findings indicated boarfish as a promising new resource, for the Portuguese coast, showing significant abundance coupled with elevated fecundity. Next, an analysis of the populations' parameters was needed and, as such, studies on age, growth and reproduction of the species were performed. In terms of age and growth, boarfish reached a maximum age of 15 years, using whole otoliths, and exhibited a biphasic growth pattern. As for reproduction, it was classified as a gonochoric species, with a yearlong spawning season and indeterminate fecundity, which seemed to substantially influence growth. Moreover, to complete this species assessment and determine its potential as new opportunity for fishers, new food products, like fried boarfish, were developed and the species nutritional aspects were evaluated. Consumers' diets and their food choices-regarding texture, flavour, colour, and appearance-were also carefully analysed with boarfish presenting a high fatty acid and protein content, and a 70% acceptance rate from consumers. In the end, boarfish showed great potential as new source of healthy and nutritious food products for humans and, hence, income for fishers. While it might not become a primary fishery, it stands as a possible alternative to other commercialized fish species. This type of analysis, which takes into consideration the species potential for fisheries, its biological parameters, nutritional and sensory characterization as well as the social response from potential audiences, could become a future approach to take into consideration to value underutilized species and transform them into new opportunities.

Fishes, fish migration and education

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Abstract content: The Center for the Study of Mediterranean Rivers-University of Vic-Central University of Catalonia (CERM) is a renowned institution dedicated to research and studies pertaining to environmental science, particularly focused on the protection and conservation of river ecosystems and migratory fish within the Mediterranean region. CERM has an educational commitment to society, and a great ability to transfer research outputs and knowledge throughout environmental education activities (https://mon.uvic.cat/cerm/divulgacio). CERM is also the environmental area of the Ter River Museum (www.museudelter.cat). CERM offers a wide range of education activities (https://www.museudelter.cat/educacio-ambiental) and materials for schools and community to disseminate the study and understanding of river environmental issues, including the need to raise awareness for the importance of free-flowing rivers and migratory fish. Fishes are essential components of the aquatic ecosystems but unfortunately are endangered or in regression due to global change impacts. Migratory fish have been essential to the welfare of human society for thousands of years as they are a significant food resource, but still more scientific dissemination and outreach is needed to highlight the importance of migratory fish to public society. For this reason, CERM has extensively organized educational activities related to migratory fish to citizens over the last 20 years. One of the events carried on following this purpose is the celebration of the "World Fish Migration Day". This event is prepared in partnership with the World Fish Migration Foundation (Netherlands), focused on the protection and conservation of migratory fish around the world by creating global attention for the challenges that migratory fish face, and supporting initiatives explaining how migratory fish need to complete their life cycles. Other educational projects and field visits have been also carried out to reach these objectives.

Estuarine fishes stressed by a fast-changing climate

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Abstract content: Estuaries are very important for ecological (nurseries, fish assemblages), economic (ports, industries and housing), and societal benefits (boating, fisheries). Estuaries and wetlands give vital services estimated around trillions of dollars nonetheless they are some of the most degraded habitats on Earth. The increase in air temperature caused a Global Warming (GW) disturbing climate that affects estuarine ecosystems, including ichthyofauna. This short literature review (SLR) was elaborated using the *ScienceDire*ct and *Pubmed* platforms. Climate changes (CC) cause alterations in hydrologic variables (i.e., rainfall patterns) that affect major physiological performance in fish and also disturb fisheries. Conversely, decreased precipitation reduces freshwater input and can also affect the salinity of coastal waters. The rising concentration of carbon dioxide (CO_2), and subsequent capture in the ocean, leads to marine waters becoming more acidic. The rising sea levels that are occurring can be a huge problem because about 30-40 % of the worldwide population lives close to the coast so the altered rain patterns, droughts, and ocean acidification threaten to degrade even more estuaries. Estuarine fish are under numerous environmental stressors like pollution, habitat fragmentation and biodiversity loss, exotic species introduction, and climate change. Additionally, fish are affected by water pollution, habitat degradation and overfishing. This SRL found that these fish impacts are different around the world and vary a lot. Estuaries specificity, complexity and diversity make it very difficult to predict CC consequences so a long-term monitoring database is vital. Climate change predictions show that GW will continue to rise, impacting the dynamics of fish assemblages (directly and indirectly), river flow, pH and dissolved oxygen decline, and increase in water temperature and dissolved carbon dioxide sea level. Estuaries are key areas, that harbour marine, estuarine, freshwater species and migratory fish species, so more monitoring research should be done including the development of a more sophisticated models to predict changes in the dynamics of coastal aquatic systems. This knowledge is important for wildlife and water quality, food security, “sea nurseries” conservation, housing, and to assess the effects of climate change to define broad and effective mitigation strategies and policies in these key areas.

There are plenty more fishes in the sea: Tempting alternatives to replace sardine consumption

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Abstract content: Sardines (*Sardina pilchardus*; Clupeidae) are among the most extensively harvested resources in Mediterranean fisheries, holding significant ecological and cultural importance throughout the region. Various anthropogenic factors, including fishing, climate change, and marine pollution, have contributed to observable signs of stress within sardine populations. These signs manifest as a decline in population sizes, a reduction in the size at first maturity and a decline in condition.

QUALISARD project aims to explore alternative species that could serve as substitutes for sardines in human consumption, in order to alleviate the pressure above this natural resource. The potential candidate species include *Sardinella aurita* (Clupeidae), *Scomber scombrus* and *S. colias* (Scombridae), along with *Trachurus trachurus* and *T. mediterraneus* (Carangidae).

Our findings corroborate *S. aurita* as a capital breeder, accumulating lipid reserves in the mesenteric cavity rather than intramuscularly, displaying a steady levels of lipid content in muscle throughout the year. Moreover, *T. trachurus* and *T. mediterraneus*, also capital breeders, share strategy with sardines by accumulating lipid reserves in both their bellies and the intramuscular tissue before the spawning season. While *T. trachurus* spawns in the cold months, *T. mediterraneus* spawns during the temperate months. Regarding *S. scombrus* and *S. colias*, results corroborated them as income breeders, with mesenteric fat absent along the annual cycle. Muscular lipid content varies more among individuals than across seasons. Similar to sardines, *S. scombrus* spawns in the cold months, while *S. colias* spawns in the temperate months (July) in the Catalan Coast.

Based on our results, *T. trachurus* emerges as a promising candidate to replace sardines during summer and autumn, while *T. mediterraneus* proves to be a suitable alternative when the sardine is not at its peak (winter months and spring). In the scenario of a year-round fisheries closure, both species could effectively substitute sardines in terms of meat quality and fatty acid consumption. Concerning *Scomber* spp, larger individuals could also serve as good candidates due to their higher meat lipid content. *S. aurita*, despite being the closest species to *S. pilchardus*, appears to be the least suitable substitute, as its meat lipid content remains relatively low throughout the year.

La Sorellona: 10 years of education, awareness, dissemination and environmental volunteering with feet soaking in the rivers of Girona

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Abstract content: La Sorellona association was born in Girona in 2013 from a small nucleus of naturalists, environmentalists, and biologists whose main objective was to work in the field of education, awareness, dissemination, and environmental volunteering. Since its beginnings, rivers and wetlands have concentrated much of our activity.

The workshops and activities in the natural environment, in this case in fluvial environments, are a way of approximating and disseminating the values of aquatic ecosystems. However, these spaces are often degraded environments and neglected by citizens, who live behind the rivers and streams that cross their towns and cities, and often even have lost their ancestral knowledge and attachment to the fauna and flora they harbor, the ecosystemic functions they perform or even the associated cultural heritage. But the current ecological improvement that has been observed in rivers like the Ter, together with a certain opening of the banks promoted by local administrations, have facilitated a timid rediscovery of our river. But our work, and that of other professionals in the sector, must be key to channeling and accelerating this revaluation of our rivers. What is not known, is not valued, or loved, and, therefore, is not preserved.

We regularly organize experiential activities such as summer camps, workshops for schools, weekend activities for families, volunteer days, workshops with groups at risk of social exclusion, large environmental festivals on the banks, and other types of activities, all of them outdoors and away from screens. Within these activities, workshops, and activities on river fish fauna have a central role.

We present a balance of our work in this field over the last decade, as well as future perspectives and objectives, focusing mainly on activities linked to the natural river heritage of the Girona district.

Impacts of simulated heatwaves and recovery over O2-Consumption and metabolic parameters of *Notothenia rossii* juveniles

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Abstract content: Heatwaves are increasingly frequent at all latitudes and are likely to cause important impacts in the physiology of organisms. Antarctic fish living in the intertidal region may be especially affected. We aimed to evaluate thermal tolerance and resilience of *N. rossii* juveniles during and after an heatwave. Fish captured in intertidal waters of King George Island were allocated to 8 groups. Two groups at 2-3°C served as controls. Temperature was raised in remaining groups to 5,8, 11°C (+3°C/d, 2 groups/condition) and maintained for 5 days after which one group per condition was sampled (s1="heat wave", 4 groups). Temperature was then gradually dropped to 2°C in continuing groups (-3°C/d; s2="resilience", 4 groups). Oxygen saturation was above 80% and fish fed ad libitum with live amphipods. Routine oxygen consumption was measured at s1 or s2, fish were sacrificed and blood/tissue samples frozen in liquid N2 for analysis. Fish (n=8) at control conditions were placed in intermittent respirometry chambers and, upon acclimation at 2°C, subjected to a stepwise temperature ramp (5,8,11°C) for 36 hours (>4 hours/step). CTMax (1°C/min; n=8) was determined for control fish. N. rossii juveniles were surprisingly tolerant to temperature (no mortality). Apparent CTmax under control conditions was between 15-17°C. Metabolic rate increased with water temperature up to 8°C but dropped at 11°C, suggesting reduced aerobic scope. Upon returning to 2°C, fish from 5°C still maintained elevated metabolic rates while those from 8°C and 11°C dropped below the control fish, indicating a decrease in energy supply capacity after the heatwave, read as costs for resilience. Results corroborate field observations (fish captured in waters of up to 4°C) and show the vulnerability of the metabolic physiology to prolonged and high amplitude heatwaves.

Will photoperiod and temperature asynchrony affect physiology of the Antarctic spiny plunderfish *Harpagifer antracticus*?

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Abstract content: Antarctica is characterized by rapid and extreme changes in daylight hours, also known as photoperiod, with winters with practically no light and summers with almost no night. Changes in daylight duration are a trigger for physiological signals for animals, including those in water such as fish, and these signals are often taken in combination with environmental temperature. Indeed, the photoperiod and temperature are usually the main signaling cues to control seasonality, one having an absolute annual consistency and the other small oscillations within a large variation, that modulate endocrine cascades leading to change. Here we aimed to evaluate how changes in Antarctic summer/winter photoperiod associated to temperature regimes impact the physiology of fish *Harpagifer antarcticus*. The animals were subjected to a summer photoperiod "20 hours of light and 4 hours of darkness", another group was subjected to a winter photoperiod "4 hours of light and 20 hours of darkness", while keeping normal summer temperature 2-3°C and high temperature 5-6°C, and sampled at 9, 18 and 36 after the onset of experimental photoperiods. Results show differences in feeding intake and enzymatic activity between species and photoperiods, and that photoperiod induce small changes in CTmax and metabolic rates in *H. antarcticus*. This appears to confirm the hypothesis that photoperiod modifies the seasonal physiology of fish, although further experiments with combinations of daylight variations are warranted. It also remains to be studied which mechanisms are responsible for the transduction of the environmental cues into physiological modifications.

Bidasoa salmon: a ray of hope for the recovery of the species

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Abstract content: Atlantic salmon populations are in clear decline throughout their distribution range, particularly concerning the Iberian Peninsula where the species faces its southern distribution limit. However, the species is showing a slow but hopeful recovery in the Bidasoa River basin. In recent years, the species has not only managed to recolonize the upper reaches of the basin, from where it disappeared decades ago, but the population has also increased from 80 spawners in the 1980-1991 period, to 400 adults in the 2009-2023 period, although with significant fluctuations (685 salmon in 2013 and 90 in 2022) that show its fragility. This improvement is the result of the implementation of three management strategies followed by the Government of Navarra for more than 30 years: 1) angling control, 2) repopulations and 3) habitat restoration. A retrospective view of the results obtained shows that there is a relationship between the application of the measures and the results that have been obtained over time and that, although not all of them currently have the same importance, the three strategies are still necessary:

1. Due to the impact that angling has on the potential egg production in the basin each year, its control is essential. For decades, the measures applied have allowed the impact of the activity to remain constant, so it cannot explain either the improvement or the deterioration of the population.
2. Repopulation with native specimens prevented the collapse of the population in the early 90s and continues to be the origin of about 35% of the salmon that return each year to the Bidasoa. However, repopulations currently do not seem to favour further progress on the species recovery and does not explain the improvements that the population has experienced in recent decades.
3. Habitat restoration has been the last of the strategies implemented and seems to be nowadays the measure responsible for the situation of relative prosperity that the species is going through in the last period (2009-2023), when the population has achieved its maximum size.

Next steps are addressed to reduce the smolt´s mortality on the downstream migration.

Long-term monitoring programs for understanding the dynamics of fish populations in Ebro Delta

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Abstract content: The Ebro Delta is a large coastal wetland that has been intensively modified, mainly for rice cultivation, involving the input of a large amount of low-conductivity waters into an originally brackish and saline System. The semi-natural aquatic systems, mainly coastal lagoons and their associated marshes, but also freshwater springs, are currently protected by the Ebro Delta Natural Park (EDNP). The EDNP is one of the areas with the highest fish diversity in the Iberian Peninsula, hosting more than a hundred species, many of which are threatened at global, Iberian and/or Catalan scale. Long-term monitoring is a necessary tool to know and manage this rich and endangered ichthyofauna. It is key to inform about species' conservation status and their temporal trends, as well as to identify the impacts of different pressures (eg, human activities, exotic species, or climate change) and plan, and evaluate, management response. The EDNP has developed a standardized fish monitoring program since 2008 involving the yearly sampling of 200 sites across different aquatic environments (coastal lagoons, irrigation channels, Ebro River, marshes and springs). The sampling methodology includes different capture techniques (mainly electrofishing and fyke nets), which are adapted to the characteristics of the different environments. In this presentation, we will show the most remarkable results of these long-term monitoring. These include first detections and descriptions of spread of invasive species (e.g. *Fundulus heteroclitus*, or *Xiphophorus maculatus*). declines of threatened native species (*Cobitis paludica* and *Anguilla anguilla*) or assessing the responses of the *Apricaphanius iberus* population to the expansion of the invasive blue crab (*Callinectes sapidus*). The accumulated experiences and results show that long-term monitoring programs are essential for understanding the dynamics of fish populations and communities and promote their conservation.

Fish Multimetric Index (FMI): Examining the relationship between hydromorphology and ichthyological fauna

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Abstract content: The Water Framework Directive (WFD) establishes the basis for the protection of inland (surface and groundwater), transitional and coastal waters in the European Union. As part of its development, Member States must ensure the quality and comparability of methods for monitoring and assessing the "status" of waters, which is a combination of "chemical status" and "ecological status". In Spain, RD 817/2015 and the "Guía de Evaluación de Estado de las Aguas Superficiales y Subterráneas" (MITERD, 2021) provide the necessary criteria for this purpose.

Three groups of quality elements are considered when assessing the ecological status of rivers: biological (QE-BIO), chemical and physico-chemical (QE-FQ) and hydromorphological (QE-HMF). The EFI+ (New European Fish Index, 2009) is the established index for assessing fish quality within QE-BIO. However, EFI+ does not currently have established reference conditions or class boundaries in Spain.

Since quality elements must respond to anthropogenic pressures, we determined the responsiveness of EFI+ to hydromorphological impacts, which are known from the scientific literature to be a perturbing factor for fish communities. To achieve this, the results obtained for EFI+ in the Segura, Guadiana and Andalusian Mediterranean basins were correlated with those obtained for the QE-HMF, which assesses the hydrological regime of the river (flows, connection with groundwater), its continuity (transverse and longitudinal) and its morphological conditions (depth, width, river bed structure and substrate, the riparian zone structure). All of these variables are involved in the fish lifecycle.

The poor response of the EFI+ to hydromorphological pressures, led to the development of a Fish Multimetric Index (FMI), that comprises four metrics related to the four aspects to which the fish fauna must respond according to the WFD (species composition, abundance, type-specific disturbance-sensitive species, and age structures). The results obtained show a significantly higher response to QE-HMF than that obtained with the EFI+.

These results demonstrate that the FMI should replace the EFI+ as fish quality indicator, at least in the studied basins. Determining whether the responses observed in the southern basins investigated are similar in other Spanish basins and even in other EU Member States will be crucial for the future.

Projecte Escanyagats: Creation and evolution of new *ex-situ* populations of Three-spined stickleback (*Gasterosteus aculeatus*) in artificial water bodies as a long-term conservation strategy for the species in Catalonia

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Abstract content: The Three-spined stickleback (*Gasterosteus aculeatus*) is an endangered species in Catalonia. It has disappeared from most of its historical range, including at least five entire basins, and the remaining populations continue to decline. Our monitoring, carried out in most Catalan populations in the northeast of the country, indicates that there has been a reduction of between 50% and 75% everywhere in the last 20 years. The remaining populations are found in highly modified stretches of mediterranean rivers, subject to multiple anthropogenic pressures, or highly vulnerable to increasingly drastic droughts due to climate change. In this context, in 2018, we initiated the "Projecte Escanyagats", a project aimed at implementing a long-term and low-cost strategy for the conservation of this species in Catalonia. We have opted for a combination of broad-spectrum measures:

- Creation of new ex-situ populations in artificial water bodies, from urban ornamental ponds to small irrigation reservoirs.
- Strategic restoration of small river stretches, mainly focused on ensuring the maintenance of flooded pools during extreme droughts.
- Reintroduction in river stretches with historical presence, initially in basins with existing populations.
- Periodic sampling to implement continuous monitoring of trends and expand knowledge about key aspects of their ecology.
- Specific awareness and environmental education campaign, as well as environmental volunteering, to engage society in the conservation of this small fish and its habitats.

In the planning of these actions, the known genetic differentiation of the remaining populations is being considered. We present the results obtained so far, focusing on the strategy of creating new ex-situ populations. The new Three-spined stickleback *ex-situ* populations have been created by translocating a small stock of individuals from pools at risk of drying up, always as close as possible to the location and belonging to the same hydrographic basin. Agreements have been previously signed with the owners, as is the case with the agreement with the City Council of Girona, where actions are being taken to naturalize urban ponds within the framework of the GiroNat project, a city renaturalization project funded by Fundación Biodiversidad.

Diagnosis of fish populations and their habitats in Riera d'Osor stream

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Abstract content: Riera d'Osor is an important stream for continental fishing activity as it contains three distinct zones: cyprinid zone, salmonid-free fishing zone and controlled salmonid fishing zone. Although is introduced in this stream, the viability of the trout (*Salmo trutta*) population in this area has become a reason of concern. An extensive sampling done in 2021, showed a poorly structured trout population, with a low adult density, and likely demographic fluctuations both reflected in a scarce and irregular recruitment and fluctuating density. Other species present in this stream are mediterranean barbel (*Barbus meridionalis*), chub (*Squalius laietanus*), and eurasian minnow (*Phoxinus* sp). To provide extended information on the current situation of trout and rest of fish species present in this stream, and the state of the watercourse in general, a complete diagnosis was carried out, focused on the fish populations, and on the whole stream habitat. To evaluate the fish population, two sampling campaigns were carried out in various points of the stream using electrofishing, obtaining information on the state of each species found, with some interesting results about the native species found and the absence of some exotic species, mainly related to barriers that hinder the longitudinal connectivity of the stream. In relation to this, the fluvial connectivity index (ICF) was applied to all the barriers found along the stream to assess their effects. To evaluate the habitat of the stream, a methodology of continuous application of the fluvial habitat index (IHF) was carried out, all along the entire course of the stream. That was performed by going through the interior of the entire watercourse and applying the index in homogenous sections according to its general appearance, with a length between 50 and 200 m, depending on the morphological heterogeneity of the section.

The results, with a high spatial resolution, make it possible to correlate the state of the fish populations in each river section with the current situation and the natural potential of the river habitats.

Diagnosis of the present situation of the Spanish toothcarp (*Aphanius iberus*) in the Llobregat Delta

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Abstract content: Currently, in Catalonia, Spanish toothcarp (*Aphanius iberus*) has a discontinuous distribution, with its main populations located in the Ebro Delta and the Empordà area. Along the Catalan coast, there are some small, isolated populations, most of them recently introduced. In the Llobregat Delta, where the Spanish toothcarp became completely extinct, some nuclei have been recovered. In 2020, a specific diagnosis was carried out to understand the current situation of the species in this protected space, and at the same time determine what factors are involved in the viability of establishing new stable nuclei. Altogether, 52 stations located in all types of water bodies (rivers, canals, lagoons, marshes) were sampled. Traps, nets or electrofishing were used for faunal sampling. In addition, in each location up to 27 quantitative variables of the aquatic habitat have been taken. Excluding species of marine origin that are only present at the mouth of the Llobregat River, only 17 species of fish have been detected in the study area. Of these, only 7 are native: *Aphanius Iberus, Salaria fluviatilis, Anguilla anguilla, Pomatoschistus microps, Mugil cephalus, Chelon ramada*, and *Chelon labrosus*. The rest of the species detected (10) are non-native: *Pseudorasbra parva, Alburnus alburnus, Luciobarbus graellsi, Gobio occitaniae, Phoxinus* sp*, Cyprinus carpio, Carassius auratus, Lepomis gibbosus, Gambusia holbrooki*, and *Silurus glanis.* On the other hand, many species still present in other coastal wetlands of Catalonia have not appeared, such as *Gasterosteus aculeatus*, *Atherina boyeri, Syngnathus abaster, Salaria pavo, Dicentrarchus labrax, Sparus aurata, Liza aurata*, among others. Then, the fish community is strongly and globally degraded. The current ecological state of most water bodies prevents the establishment of the Spanish toothcarp, and even most native fish. If large ecological, hydrological, and environmental restoration projects are not promoted in this area, the only option for the Spanish toothcarp is through small bodies of water isolated from the rest, preferably located behind the dune range.

Completeness of the "Carta Piscícola Española" data, the Spanish database of freshwater fish occurrences

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Abstract content: Freshwater ecosystems harbor an incredible diversity of fish species, yet they are increasingly imperiled by a multitude of threats such as pollution, habitat degradation, invasive species and climate change. Freshwater fish species represent one of the most threatened groups of vertebrates. In Europe, this group boasts the highest species richness among vertebrates and is characterized by a significant number of endemic and endangered species. In this context, the Mediterranean region, particularly the Iberian Peninsula, stands out as a unique environment with the highest percentage of endemism in Europe. One effective approach to properly establishing and focusing conservation efforts is to understand the diversity of species within a specific area. In this regard, databases serve as a crucial source of information regarding species presence. However, the challenge lies in the completeness and variability of information within these databases, which may hinder the accurate assessment of species richness in an area. To evaluate the reliability of information within databases about the presence of freshwater fish species in Spain, we analyzed the species information from the Spanish Fish Chart. For this purpose, we used the measure of completeness, which indicates the thoroughness of inventory records and identifies areas requiring additional sampling effort. We worked with the R package "KnowBr" which uses accumulation curves and estimators to retrieve completeness values. We calculated this value for each sub-basin in Spain to identify well-surveyed areas and those needing more survey effort. The completeness of fish data records in the country is irregular; our analysis permits the detection of what geographical regions should be prioritized to achieve a complete map distribution of Spanish fish species.

The most irreplaceable freshwater places for fish conservation in relation to protected areas of Spain

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Abstract content: The conservation of freshwater ecosystems is imperative for maintaining biodiversity and ecosystem services worldwide. In Spain, numerous protected areas play a crucial role in preserving these vital habitats, particularly concerning fish conservation. Spain boasts diverse freshwater ecosystems, including rivers, lakes, and wetlands, harbouring a wide variety of fish species. However, current conservation strategies do not seem to protect freshwater biodiversity efficiently. Despite ongoing efforts, the conservation of freshwater biodiversity in Spain faces significant challenges, indicating shortcomings in current strategies. This study aims to detect irreplaceable freshwater areas regarding fish biodiversity with the aim of prioritising these areas for freshwater conservation. Firstly, we estimate the probability of species occurrences in all the freshwater basins of Spain using species distribution models. These probabilities were weighted according to the rarity, richness, and conservation status of freshwater fish fauna. The irreplaceability was then estimated as the sum of those values in each Spanish freshwater basin. The overlap between irreplaceable basins and the present network of Spanish protected areas was also calculated. According to the United Nations 30by30 target, we select the 30% more irreplaceable freshwater basin. Protected areas do not seem to provide sufficient protection to these basins. This study highlights the most irreplaceable freshwater locations in relation to Spain's protected areas and underscores their significance for fish conservation efforts. Continued conservation efforts and effective management strategies are essential to ensure the long-term sustainability of these critical habitats and the invaluable biodiversity they harbour.

What would efficient data management mean for Spanish freshwater fish conservation?

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Abstract content: Biodiversity continues to decline, but the resources for its conservation are limited, and their prioritization is urgent. Therefore, it is necessary to achieve efficient data management to improve decision-making and conservation planning. Although access to information has enhanced remarkably in recent years thanks to open access policies, a large amount of information is routinely generated but, unfortunately, not easily accessible. Regarding efficiency, there are a lot of routine activities that generate biodiversity data used for their initial purpose but not shared and thus not well-spent for future studies. These data, almost invisible to potential users and remaining underused and eventually lost, are often classified as dark data. However, these dark data can be a powerful tool for better decision-making and conservation planning if we can make them findable, accessible, interoperable, and reusable (FAIR). The Iberian Society of Ichthyology (SIBIC) has developed the Spanish Fish Chart (https://www.cartapiscicola.es) to make all the information on Spanish freshwater fishes accessible. It has gathered all the data from research centers and public administrations to achieve this objective. Much of the collected data is available on its web platform, but all the information is stored in a relational database. We checked which information in the database was -and was not yet-digitally accessible, thus having a sample of all the freshwater fish data produced that reached potential users and a sample of the dark data. We analyzed the contribution of the dark data to our current knowledge of Spanish freshwater fishes, assessing changes introduced in the estimation of two spatial metrics used for evaluating the conservation status in the IUCN Red List Criteria: the extent of occurrence (EOO) and the area of occupancy (AOO). Biodiversity dark data, if FAIRified, besides increasing the efficiency of data management and generation, could improve the assessment of the conservation status of natural populations.

The role of connectivity in conservation planning for species with obligatory interactions: Prospects for future climate scenarios

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Abstract content: Climate change may lead to range shifts, and barriers to such displacements may result in extirpations from previously suitable habitats. This may be particularly important in freshwater ecosystems that are highly fragmented by anthropogenic obstacles, such as dams and other smaller in-stream barriers. Conservation planning in freshwaters should consider the dynamic effects of climate change and the ability of species to cope with it. In this study, we developed a framework for incorporating climate-driven dispersal barriers into conservation planning taking into account the medium and long-term impacts of climate change and species with obligatory interactions. Given that freshwater mussels (*Bivalvia: Unionida*) are a group of highly threatened organisms dependent on fish hosts to complete their larval development and dispersal, we used Marxan to prioritise areas for their joint conservation in the Iberian Peninsula as a case study. We tested two connectivity scenarios between current and future habitats, i) unlimited dispersal capacity and ii) dispersal constrained by artificial barriers, and also identified priority translocation areas for species that were unable to disperse. Accounting for the effects of climate change on species distributions allowed the identification of long-term conservation areas, but disregarding artificial barriers to dispersal may lead to unrealistic solutions. Integrating the location of barriers allowed the identification of priority areas that are more likely to be colonised in the future following climatic shifts, although this resulted in an additional loss of 6 to 8 features (~5-7%) compared to solutions without dispersal constraints. Between 173 and 357 artificial barriers (~1.6-3.3%) will potentially block species dispersal to irreplaceable planning units. Where removal of artificial barriers is unfeasible, conservation translocations may additionally cover up to 8 additional features that do not meet conservation targets due to dispersal constraints. This study highlights the challenge of identifying protected areas to safeguard biodiversity under climate change.

Watershed Management Model for fish restoration

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Abstract content: In a global change scenario, there are plenty of pressures above native fish that reduce their populations by competition with invasive species or split populations due to river barriers proliferation that prevents fish reproductive migrations upstream. This situation makes necessary join in fishery management in order to preserve the most endangered and valued fish species populations for good ecological condition of river ecosystems. Facing this problem requires to study and plan a strategy by minor watersheds. The Fishing Department of Extremadura Government presents a methodology in this regard.

1. Define the watershed in study and inventory the permanent waterbodies inside through orthophoto and satellite images.
2. Electrofishing in selected waterbodies to know the distribution patterns along the watershed. In addition, these ponds should be characterized to evaluate their establishment as reservoirs of native fish species (where fishing will not be allowed) or, otherwise, the options to draw them off to eradicate invasive species.
3. Choose river stretches for capture of natives and suitable ponds for release them.
4. Eliminate invasive fishes by drawing off the infected ponds and dams in a descending order (from upstream to downstream).
5. Prepare the ponds as breeding areas with the creation of refuges and restocking with natives from the selected donor waterbodies.
6. Carry out an inventory of river barriers and spawning grounds after walking thought river courses of the hydrographic network of the minor basin under study.
7. Strengthen fish stocks in the river by restocking with fry from the breeding ponds.
8. Monitoring fish populations by sampling stations in waterbodies and carrying measures out for restoration and preservation of fish habitats in freshwater.

Strategic ponds for biodiversity: a new approach to the conservation of fishes species and habitats in times of climate crisis

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Abstract content: In this work, strategies for the conservation of native fish species in a section of the Siurana River are explained. This river segment is increasingly affected by the climate crisis and reduced water flow from the headwater reservoir. The rocky substrate in this section creates ponds where thousands of native fish species such as *Parachondrostoma miegii, Barbus graellsii, Squalius sp., Barbus haasi,* and *Anguilla anguilla* take refuge.

Unfortunately, these ponds, which used to maintain acceptable water levels even during droughts and disconnected river episodes, are now drying up due to the worsening climate crisis. The recurring impact of these events will lead to the collapse of fish populations in this river stretch, with no possibility of recovery once the river reconnects.

To address this situation, population characterizations and monitoring of fish populations have been conducted, along with control and removal of exotic species. In 2022, water supply measures were implemented effectively to maintain these strategic ponds, preserving their functionality and fish populations.

Given the similar situation in other studied temporary river sections (such as Canaletes and Brugent), it is proposed to develop a Strategic Ponds Plan for Biodiversity. This plan would include water contributions to prevent the collapse of native fish and macroinvertebrate populations during increasingly frequent extreme droughts in Mediterranean temporary rivers. Possible measures includes land stewardship agreements with irrigation communities, creating external water-reserve pools for providing water to ponds in extreme droughts, or using existing the pools to prevent forest fires by making targeted water contributions to the strategic ponds.

This plan could be replicable to other river areas and should be part of a broader Drought Biodiversity Plan for Mediterranean river basins.

Fish population evolution in the Riera Major stream (Ter River Basin, NE Catalonia)

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Abstract content: The Center for the Study of Mediterranean Rivers-University of Vic-Central University of Catalonia since 2018 is carrying out regular monitoring of the state of the population of fish and aquatic macroinvertebrates in the Riera Major stream (Ter river basin) commissioned by the Guilleries-Savassona Natural Area Consortium. Several parameters of fish population are evaluated (taxonomic composition, ind/100m, biomass/ha and IBICAT2010 index) and also biological indices of water quality based on aquatic macroinvertebrates (IBMWP, IASPT, FBILL, EPT, OCH) and its biomass, complemented by the calculation of hydromorphological indices of river habitat (IHF and RBPS) and riparian vegetation quality (QBR). Physicochemical parameters of water obtained by means of portable probes (temperature, pH, electric conductivity and dissolved oxygen) and river flow are also obtained.

2021 and 2023 has been very dry years with lower flows throughout the Ter basin. Water temperature in several stretches in summer has remained at very high values, exceeding 22ºC between July and August. Ominous temperatures for trout survival.

Throughout the period 2018-2023, a decrease in brown trout (*Salmo trutta*) and Mediterranean barbel (*Barbus meridionalis*) populations and an increase in minnow (*Phoxinus* sp.) has been observed.

Although an increase in sediments, basically sand, has been detected, aquatic habitats maintain a good and very good quality. The poor ecological connectivity for fish, due to the presence of several weirs, remains an important pressure. It is also very necessary to reduce organic discharges upstream.

The recovery of freshwater blenny (*Salaria fluviatillis*) population in the Albufera lagoon (Valencia)

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Abstract content: The river blenny (*Salaria fluviatilis*) is the unique freshwater fish of the blenny family, as the rest of the species belong to coastal marine waters. It is distributed throughout the Mediterranean basin, and in the Valencian Community it is found throughout the Júcar basin, with some well-preserved populations in the Júcar and Cabriel rivers. Currently, this species is included in annex I in the category of Vulnerable of the "Valencian Catalogue of Threatened Fauna Species" and in the same category in the "Spanish Catalogue of Threatened Species". Although in 1979 it was considered extinct in *l'Albufera* lagoon (Valencia) due to the regression of the species since the 1960s, in 2013 a specimen was rediscovered after the conversion of the *Tancat de Milia* (a rice field) to an artificial wetland. In view of this discovery, the "Centro Acuícola el Palmar" (CAEP) has carried out biennial surveys in the lagoon to assess the evolution of its population from 2013 until today.

During the first surveys in 2013, its presence was confirmed at 12 of the 17 sites sampled. A total of 74 individuals, both adults and juveniles, were captured. From this date, and although catches of blennies increased from 2013 to 2017 (with more than 300 specimens counted), captures decreased significantly during the 2017 and 2021 campaigns, where less than 40 specimens have been counted in the sampling points. This situation may be explained justified by the important episodes of heavy rainfall in recent years, which have caused significant amounts of decomposing plant debris in the lake, which have clogged the gravel areas crucial for the blenny's habitat and breeding. On the bright side, exotic fauna in the lagoon, like pumpkinseed (*Lepomis gibbosus*) specimens, do not seem to significantly affect blenny populations. These sampling campaigns have reported valuable information about the biology and ecology of the species, but future samplings will provide insights into the population evolution of the species and its role as a bioindicator of water quality in *l'Albufera*.

Ichthyological environmental indicators in the renaturation of urban rivers: the case of the Piles and Peñafrancia rivers

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Abstract content: The urban growth has turned urban rivers into marginal, degraded and polluted places, as many of them have been subjected to several modifications, including river channelling or their use as urban and industrial waste drains. From an environmental perspective, river renaturation involves restoring their ecosystem functions, but determining its success is a great challenge for environmental consultancies, as there are a large number of factors involved in the process. One of the best environmental tools available is to know the state and health of the ichthyological community of the river stretch to be restored, as it is able to indicate the level of degradation it is suffering. This report presents a study carried out in the urban rivers Piles and Peñafrancia located in the city of Gijón in northern Spain using the ichthyological community as an environmental indicator of river degradation in order to locate areas where renaturation efforts should be focused. During the field work, the ichthyological characterisation was carried out, as well as the estimation of the European Fish Index (EFI+) and the Cantabrian Fish Index (CFI). A total of 1421 individuals belonging to eight different species were analysed during the sampling. It has been observed that the stations located on the outskirts of the city show a salmon-type community consisting mainly of European eel (*Anguilla anguilla*), brown trout (*Salmo trutta*) and Adour minnow (*Phoxinus biguerri*). However, in the sections located downstream of the confluence of the two rivers and closer to the city, the communities become suprahaline-salmonid type, consisting mainly of Adour minnow, European flounder (*Platichthys flesus*) and flathead grey mullet (*Mugil cephalus*). All the sections analysed have a “good” / “potentially good” or “very good” ratio of ecological quality of ichthyological fauna, except for the last two sections of the river Piles, which are in the “moderate”, “poor” or “bad” category, depending on the section and the index applied. We conclude the importance of the study of the ichthyological community and the importance of focusing efforts during the renaturation processes in the last sections of the Piles River in order to improve the ichthyological state and health.

Abstract Title: Genetic diversity and divergence in the endangered *Anaecypris hispanica* (Steindachner 1866): implications for its conservation

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Abstract content: The Iberian Peninsula is considered a hotspot for its continental ichthyofauna, with the Cyprinidae family having the highest representation of endemic species. Of the countries in the European Union, Spain is among the ones with the highest proportions of endemic freshwater fish species (>80%), but it is also a country with one of the highest numbers of invasive freshwater species (>200 species). The Iberian endemic jarabugo or *Anaecypris hispanica* (Steindachner, 1866) is the only representative of the genus *Anaecypris*, that inhabits the Guadiana basin and the Bémbezar river in the Guadalquivir basin. It is a small cyprinid that lives in watercourses subject to large water fluctuations and is classified as Endangered (IUCN, 2023) and Critically Endangered in Portugal (Magalhães et al., 2023). Its main threats are competence for water resources, habitat fragmentation, and the introduction of invasive alien species (e.g. *Alburnus alburnus*), all of which have led to the rapid decline of its populations. Due to the critical state of the jarabugo populations in Extremadura, the Junta de Extremadura has implemented a recovery plan to ensure its survival. One of the measures to be considered is the determination of the genetic variability of its populations to identify possible population differences, and thus, have a better knowledge of the species. For this reason, in this study, we will analyze the genetic variability of individuals from 17 populations in the Guadiana basin and 2 in the Guadalquivir basin. This analysis will be carried out using a mitochondrial gene (cytochrome b) and a nuclear gene (beta-actin) to identify inter- and intra-population haplotypic variations that will be useful for establishing conservation units. In addition, future distribution models will be used based on the current distribution of the jarabugo, identifying areas likely to maintain populations with greater survival success in the future.

Conservation of Samaruc (*Valencia hispanica*) and recovery of the ecological state in the Santes Creus lagoons (Ametlla de Mar, Tarragona) through the eradication of mosquitofish (*Gambusia holbrooki*) with rotenone

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Abstract content: The lagoons at the mouth of the Torrent de Santes Creus form a small coastal wetland area of high ecological value, first, due to its intrinsic characteristics and good ecological status, and second, due to the presence of an important population of Samaruc (*Valencia hispanica*). Samaruc is an Iberian endemism, classified as CRITICALLY ENDANGERED OF EXTINCTION (CR). In addition, this space is protected by the Natura 2000 Network. Technicians from the Ebro Delta Natural Park (PNDE) have been monitoring this population of samaruc for more than two decades. In 2006, the introduction of mosquitofish was detected, a fact that led to a gradual regression in the density of the samaruc, apart from compromising the ecological status of the lagoons. On the other hand, since 2014, Fundació Andrena and Paisatges Vius entities, with the collaboration of the PNDE, have been promoting the "SOS Samaruc" project with the aim of promoting conservation actions for this threatened fish species, which complement the efforts developed since PNDE itself for about three decades. Among these conservation actions, in 2022 a project was carried out to eradicate gambusia in these lagoons by applying rotenone, with funding from the Catalan Water Agency. The technical execution of the eradication project has been subcontracted to Sorelló, although all technical work has been planned collaboratively with the extensive scientific-technical team involved. In fact, there has also been the direct involvement of two scientific teams from the CSIC, for limnological and chemical monitoring. For part of the action, additional co-financing has also been taken advantage of through the LIFE RESQUE ALPYR project (LIFE20 NAT/ES/000369), which has adopted this project as a pilot test prior to planning new treatments with rotenone in Pyrenean lakes, planned from 2023. The plans and protocols developed, the field actions developed, an extract of the experimental tests designed, the monitoring implemented, the provisional results, as well as the problems and vicissitudes that occurred, among other aspects of this pioneering action, are presented.

Viability of the South Iberian Spined Loach (*Cobitis paludica*) in the upwellings of the Ullals de Baltasar (Ebro Delta NP)

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Abstract content: The small wetland of Ullals de Baltasar, located in the Ebro Delta, and made up of a complex of lagoons and ditches fed by spring waters, is a place of great strategic importance for the conservation of Iberian fish. Here, nuclei of several threatened species persist and coexist, such as the stickleback (*Gasterosteus aculeatus*), Valencia toothcarp (*Valencia hispanica*), big-scale sand smelt (*Atherina boyeri*), or South Iberian spined loach (*Cobitis paludica*), among other native species. Unfortunately, numerous introduced species have also penetrated here, such as wels catfish (*Silurus glanis*), oriental weatherloach (*Misgurnus anguillicaudatus*), topmouth gudgeon (*Pseudorasbora parva*), mosquitofish (*Gambusia holbrooki*) or common platy (*Xiphophorus maculatus*), mentioning only the most common currently.

As for the South Iberian Spined Loach, first, it should be emphasized that this is the last known population in Catalonia, and one of the few remaining in the Ebro basin. However, in recent decades an abrupt decline in its density has been observed. In fact, this species should probably be considered extinct in the area. The few specimens detected during the latest sampling campaigns come from releases of specimens from the ex-situ conservation program promoted by the natural park. This program began with the last wild specimens captured in the area.

In 2019, a detailed study was carried out on the habitats and fish population of the area, to evaluate the possibilities of long-term persistence of the South Iberian Spined Loach, and at the same time provide practical knowledge for better planning of the release of specimens from the captive stock. Together with the data from the annual monitoring carried out from the natural park, the results of this study have allowed us to determine the viability of this critically endangered species.

The results are presented. Various sectors have been identified with habitats still suitable for the species, and with a high potential to host a stable population. However, the real viability of its reintroduction is completely limited by the progressive proliferation and increase in abundance of invasive exotic species of fish and other groups of aquatic fauna.

Traditional fishing reservoirs

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Abstract content: Very few dammed waterbodies in Extremadura are free of exotic fish species because of the huge dispersal capacity as well as the difficulty in their control. The problem goes worse when in rainy seasons water overflows dams and ponds and they reach the river system downstream competing with natives. According to the objectives of *The Nature Restoration Plan, a core element of the Biodiversity Strategy*, our modern fish farming has changed in recent years as achieving native fish breeding as a likely solution to face this bad tendency. However, current freshwater aquaculture of native species is not able to cover all the river system needs. The Fishery and Aquaculture Department of Extremadura Government have developed the so-called "*traditional fishing reservoirs*" so that this situation will be reversed. That includes small and medium dammed waters in which invasive fishes have completely been eliminated by racking water from the infected pond to other in a safety way. Just only free of invasive fish species the pond is stocking with native fishes. Most important goal of these "*traditional fishing reservoirs*" are being a source of natives and consequently, they restock with native fish populations located downstream in a natural way each time the water overflows and go down during rainy seasons. Secondly, this initiative involves local anglers in native fish breeding due to the fact they choose the proper waterbody where they usually fish in. Besides, sport fishing (capture and releasing) is supported, promoting ecological and cultural value instead of "trophy fishing" of big exotic predators. Since 2021 have already been created 20 "*traditional fishing reservoirs*" distributed throughout Extremadura, to the success of the good condition of freshwater ecosystems and the enjoyment of fishermen.

GiroNat Project: planned river restoration actions

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Abstract content: The GiroNat project, financed with European Next Generation funds through Fundación Biodiversidad, aims to change the city of Girona through renaturalization, making it a greener, more resilient, and healthier city. The project started in October 2022 and will end in December 2025. One of the pillars of the project is river restoration, of great importance in a city that integrates rivers into its urban fabric around a river confluence area formed by 4 rivers. As in so many other cities, urban growth, hydrological regulation, canalization, and the construction of transversal structures have led to a profound change in river ecosystems. Among the most notable impacts are the loss of longitudinal connectivity for fish due to the presence of barriers, the degradation of riparian forests, the erosion of riverbanks due to incision and erosion processes, occupation by infrastructure, and the loss of permanent water points in mediterranean rivers with severe summer droughts due to silting of natural pools.

The main objective of the actions is the ecological restoration of the rivers of Girona for the functional improvement of their ecosystems, both at an ecological and social level. The actions focus on these 4 aspects:

- Rehabilitation of the river connectivity of the main axes, with the construction or adjustment of at least 2 river connectors.
- Restoration of riparian forests in different river sections, through the planting of native species and the elimination of exotic flora.
- Restoration of eroded banks with Nature-Based Solutions (NbS), stopping the acute erosion of about 200 meters of bank.
- Recovery of pools in streams, through the extraction of accumulated sediments that have clogged them.

The scheduled actions are presented, as well as the first diagnostic work carried out.

Understanding the vulnerability and conservation of spawning aggregations: a study on demersal sparids in south-west Portugal

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Abstract content: Spawning aggregations are groups of fish that gather in large numbers for the purposes of reproduction, playing a crucial role in maintaining fish populations. These aggregations show a particular vulnerability to overfishing because of their predictable characteristics, such as site fidelity and seasonal recurrence. Consequently, safeguarding spawning aggregations should become a conservation priority. Despite their significance, there is a lack of information on these aggregations, especially in temperate regions, hindering effective protection. In continental Portugal, purse-seine fishing vessels primarily target small pelagic fish but also incidentally catch other species, including demersal Sparids-some of them commercially valuable. On average, by-catch from purse-seiners accounts for approximately 20% of the yearly landings of demersal Sparids in Portugal, representing a substantial proportion of the overall catch. Given the bulk catches of this fishery, and fishermen's interest in their maximization, this fishing gear may purposefully target spawning aggregations, thereby posing a high threat to such species. Nonetheless, if those locations and timings are known, these fishing operations also present an opportunity to obtain information related to vulnerable spawning aggregations. Local fishermen have reported that demersal Sparids form spawning aggregations, particularly the white seabream. However, further information allowing to protect these vulnerable events is lacking. This abstract presents an ongoing study on the locations of spawning aggregations of demersal Sparids in south-west Portugal. The aim of this research is to identify and analyse these aggregations using a combination of spawning season knowledge, official daily landings data from purse-seiners, and georeferenced vessels tracks from the Automated Information System (AIS) in multiple years. By analysing long-term landings data, we also investigate the influence of environmental cues on the occurrence of spawning aggregations. The findings obtained from this study will be incorporated into the final poster presentation, providing valuable insights into the efficacy of relevant legislation and current Marine Protected Area zoning in protecting these aggregations.

The Effect of Wastewater Treatment Plant Effluents on Olfaction in the Lusitanian Toadfish

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Abstract content: Olfaction is essential for most animals. Fish detect natural odorants, such as amino acids, bile acids and inorganic cations, to avoid predators, find food, identify conspecifics, and aid migration. Anthropogenic input can affect such behaviours through sub-lethal toxicity to the sensory organs (e.g., heavy metals) and/or altering odorant bioavailability (e.g., ocean acidification). However, the indirect effect of anthropogenic chemicals acting as odorants is unknown, a concept known as 'olfactory disruption'. In Europe, micropollutants, such as pharmaceutical compounds, personal care products, and additives, arrive in aquatic ecosystems through wastewater treatment plants (WWTP) and cause changes in fish behaviour and metabolism, and increased intersex *for example*. In this study, we aimed to evaluate the effect of WWTP effluents on olfaction in the Lusitanian toadfish-*Halobatrachus didactylus*-a bottom-living fish resident in Ria Formosa, a marine lagoon system in southern Portugal which receives effluent from several WWTPs.

The olfactory sensitivity of the toadfish to WWTP effluents, and the five most abundant drugs found in such effluents, was assessed using the electro-olfactogram (EOG), a D.C. field potential recorded from the olfactory epithelium. These effluents evoked large amplitude EOG responses; most of the olfactory activity was contained in the filtrate after passing through C18 and HLB solid-phase extraction cartridges, suggesting that the odorants involved are polar compounds; the C18 and HLB eluate (non-polar, hydrophobic compounds) evoked smaller amplitude responses. However, the five drugs tested (caffeine, atenolol, carbamazepine, erythromycin and diclofenac) were only detected at concentrations orders of magnitude above those found in the Ria Formosa. On the other hand, brief exposure (1 minute) of the olfactory epithelium to untreated WWTP effluent caused a slight but, significant, reduction in EOG responses to some odorants (bile acids) suggesting some sub-lethal toxic effect. Taken together, these results suggest that (i) some anthropogenic compounds in WWTP effluents are detected by the olfactory system of fish, (ii) WWTP effluents may contain substances that are toxic to the olfactory system, and (iii) these effects are unlikely to involve the most common drugs found in such effluents. Future studies will address if, and how, such odorants may cause olfactory disruption.

Temporal trends of the Mediterranean brown trout (*Salmo trutta*) in Catalonia: influence of environmental factors and extreme flooding events

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Abstract content: The brown trout (*Salmo trutta*) is a valuable recreational fishing resource in Catalonia. To assist management decisions for the long-term persistence of the species, a systematic monitoring programme has been implemented across 187 sampling stations since 2016, focused on assessing the conservation status of the native Mediterranean lineage and monitoring the temporal trends in abundance and biomass. We found substantial variability in brown trout density among sites and years. This was expected because trout density at any given site or year can be related to local biotic and abiotic factors that greatly differ among rivers. Throughout the overall period 2016 to 2023, we did not observe a regional decreasing trend in brown trout density or biomass, but our study revealed significant short-term declines in both density and biomass during 2020 sampling. In January of that year, Storm Gloria, a Mediterranean tropical-like cyclone, led to extreme flooding events causing negative effects on trout populations. However, temporal data indicated a rapid recovery in subsequent years. Correlations between trout populations and environmental factors revealed that the altitude of the site and the proportion of gravel and cobble positively influenced the density and biomass of trout. The major concern related to the conservation of the native trout is the widespread introgressive hybridization with non-native hatchery trout of Atlantic origin, because of past stocking activities. This has drastically reduced the range of genetically pure Mediterranean trout populations to only 10% of their historical distribution. Within streams supporting pure Mediterranean populations, the annual average fish density showed a significant upward trend during the monitored period. In contrast, hybrid populations remained stable, and no temporal trend was observed. The recovery after the Gloria Storm was greater in river stretches inhabited by pure or minimally introgressed Mediterranean trout, suggesting a superior adaptation and resilience to extreme climate events. The range of brown trout densities estimated in this study can guide managers in setting achievable goals for fisheries management and restoration efforts.

Population dynamics of the Iberian Toothcarp (*Apricaphanius iberus*) in two different environments: effects of human management and habitat disturbance

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Abstract content: This study investigates the population dynamics (size structure, occurrence and abundance) of the endangered Iberian endemic *Apricaphanius iberus* along 8 years in two critical habitats: the Mar Menor shallow areas and adjacent saltpans. In the former, we assessed the influence of the extent of human disturbance (i. e. artificial beaches) with the associated modification of the hydrodynamic regime (renewal vs standing waters), as well as the effect of the dulcification in natural saltmarshes. In adjacent saltpans, we evaluated the effects of three different scenarios of saltpan management (abandonment, preventive management, and active production) on *A. iberus* population dynamics. In addition, we explore the effects of habitat variables (substrate particle size, submerged vegetation cover, depth, salinity, artificial structures representativity, saltmarsh ponds representativity, among others) in occurrence and abundance with general additive models (GAMs). For shallow areas, our findings revealed both non-dulcified natural saltmarshes and artificial beaches with low hydrodynamics showed the highest abundance and occurrence, being the latter more stable among years. However, the species' abundance and occurrence were lowest in the abandoned and preventively managed saltpans, which also showed a high interannual fluctuation. Conversely, active salt exploitation led to a greater temporal stability of *A. iberus* populations and a higher portion of larger individuals in the exploited saltpans. The study also found that the species was generally dependent on submerged vegetation cover in both environments. In saltpans, the maintenance of medium water depth levels and the avoidance of extreme salinity values were crucial for population stability. For shallow areas, a moderate presence of ports and salt marsh ponds was also a significant factor, along with the dominance of mud substrate. Our results underscore the importance of sustainable exploitation of saltpans for maintaining *A. iberus* populations and highlight the influence of human-induced changes in habitat structure and ultimately in population dynamics. This research provides valuable insights for the management of this endangered species and its relevant habitats. Part of this research was supported by the Environmental and Mar Menor Service of the Government of the Autonomous Community of Murcia (Spain), within the framework of the Biological Monitoring Program of Coastal Saltpans.

Recovery of native fish populations after a forest fire in a temporary river

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Abstract content: In July 11th 2022 an important forest fire affected more than 9000 ha in "la sierra de Francia" (Salamanca, Spain), including the Tenebrilla river basin: a temporary river that harbor a population of sarda (*Achondrostoma salmantinum*), brown trout (*Salmo trutta*) and Iberian chub (*Squalius carolitertii*). The aim of this work was to evaluate the effects of the fire on those native fish populations. From 2017 to 2023 abundance and population structure of these species was analized in a location intensively affected by the fire. Prior to fire, *A. salmantinum* was the dominant species in this sampling station. Immediately before the fire (June 2022) estimated abundances were 296±59 ind, 50±3 ind, 51±5 ind and for *A. salmantinum, S. trutta* and *S.carolitertii* respectively. Immediately after the fire (September 2022) population abundances droped 80% for brown trout and 65% for Iberian chub. In contrast, sarda abundance only decreased a 17%. Moreover, sarda was able to maintain a well-structured population after the fire. One year later abundance of Iberian chub and sarda increased up to pre-fire levels while brown trout recovered more slowly. Data show a greater resistance of sarda to extreme conditions and a greater resilience of endemic cyprinids under adverse environmental conditions. Long-term monitoring will show us if this trend continues or if late effect of fire are evident.

Fish population evolution during a restoration project. A case of study in the Ter River (Osona region, NE Catalonia)

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Abstract content: The Center for the Study of Mediterranean Rivers-University of Vic-Central University of Catalonia has been done the monitoring of the Life Alnus project using indicators for aquatic environments and habitats (in relation to macroinvertebrates and fish) and riparian ecosystems (in relation to forest sites, birds, bats, and other mammals).

The aim of this monitoring is to assess the impact of the habitat conservation and restoration measures taken in relation to the bioindicator communities and organisms, basically, the hydromorphological restoration of the Gambires and Sorral islands, carried out between the autumn of 2021 and May 2022.

Several parameters of fish population are evaluated (taxonomic composition, ind/100m, biomass/ha and IBICAT2010 index) and biological indices of water quality based on aquatic macroinvertebrates (IBMWP, IASPT, FBILL, EPT, OCH) and its biomass, complemented by the calculation of hydromorphological indices of river habitat (IHF and RBPS) and riparian vegetation quality (QBR). Physicochemical parameters of water (temperature, pH, electric conductivity, and dissolved oxygen) and river flow are also obtained.

The fish community in the Ter River in its middle section in the Osona region is made up of at least eleven species. Invasive species represent the largest proportion, with only two indigenous species being found among the eleven: Mediterranean barbel (*Barbus meridionalis*) and Catalan chub (*Squalius laietanus*). The most abundant species of fish at all the sampling points and gauging stations was the minnow (*Phoxinus* sp.), originating from Central Europe.

Monitoring the fish communities in a small intermittent river towards conservation and restauration: The case of Ribeira da Menalva in the Benémola protected landscape area (Loulé, Portugal)

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Abstract content: The populations of endemic fish species in Iberian Peninsula have been decreasing due to habitat loss or degradation and the appearance of invasive alien species. In the Algarve region, typical summer droughts increase mortality episodes in some ecosystems and generate genetic bottlenecks that represent an additional risk of extinction for native fish. Local Protected Landscape Areas are usually created in spots of relevant biodiversity, under jurisdiction of local authorities. Fonte Benémola is one of such hotspots, benefiting from seasonal springs that maintain, to date, a year-round aquatic landscape supporting the surrounding ecosystems and, in the past, fertile agriculture aided by river flow-regulating and reservoir-creating structures.

To provide information towards the conservation of this vulnerable aquatic environment, the fish fauna in the Protected Landscape of Fonte Benémola was characterized. Fish were sampled by electric fishing, six times throughout the year, covering seasonal regimes, with the characterization of the fish communities (relative abundance), assessment of the populations of native species (dimensional structure and condition), and identification and relative abundance of alien species. Four sampling units (UAs) were defined, in lotic and lentic sections of the stream, corresponding to areas confined by small dams. Six native (*S. alburnoides*, *S. pyrenaicus*, *S. aradensis*, *I. lemmingii*, *C. paludica*, *A. anguilla*) and two non-native species (*L. gibbosus* and *G. holbrooki*) were identified. Relevant differences in composition and structure of fish communities were observed throughout the year and among the UAs, which are primarily the result of altered hydrodynamics, habitat diversity and effects of summer drought. Under current climate and hydrological conditions, the structures previously built to retain water constitute a trap, leading to “reverse selection”, attracting the fittest animals during the reproductive season but impeding their escape (and of their progeny) during drought. Furthermore, these environments reduce flow which favor the establishment of invasive species downflow. Such studies allowed for recommendation of corrective measures to local authorities, to manage and conserve species and habitats under the changing climate conditions.

Understanding blue Sharks in the Bay of Biscay

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Abstract content: There is an increasing concern about the elasmobranchs' population drastical reduction due to their vulnerability and overexploitation during last decades. Understand their biology, dynamics and habitat use is crucial to help creating management plans that include them and/or improving those that already exist. Blue shark (*Prionace glauca*) is considered one of the most abundant pelagic shark species worldwide and it is distributed in tropical and temperate waters. It is the most captured shark species, as both, target (for commercial and recreational fisheries) and bycatch species (in tuna and swordfish longline fisheries). The Bay of Biscay is an important area for this species, as it is one of the areas with most sightings of this species in the world. In the Basque coastal area, blue shark juveniles have been mainly observed during summer but in the last year they seemed to extend their season until end of November, with the smallest individuals sightings occurred at the end of this month. On contrary of what was occurring in previous years, bigger individuals were observed during the season without a clear sex predominance. To understand their preferences, habitat use and seasonality, we started a study where 14 individuals were tagged during the 2023 summer. Preliminary results showed that the tagged individuals moved around the southeastern Bay of Biscay area, mainly following the continental slope. This is only the first step for a deeper understanding of the blue sharks in the Bay of Biscay, where our study is continuing.

Exploring potential dynamic time-area closures to reduce silky shark bycatch in the European tropical tuna purse seine fishery operating in the Eastern Atlantic Ocean

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Abstract content: Effective fisheries management has been instrumental in improving stock status for commercial target species of tunas and billfishes globally, as well as reducing risk for non-target species. Yet extinction risks in oceanic sharks being incidentally caught in these same fisheries remain increasing. Reducing the incidental catch ("bycatch") of shark and ray species remains a priority in tuna Regional Fisheries Management Organizations (tRFMOs). Most of the management measures in place have focused on minimizing the mortality of the incidental catch and not actually avoiding the interactions of fisheries with vulnerable shark and ray species in space and time. Spatial measures such as dynamic or fixed time-area fishery closures could complement existing measures to reduce the interactions between bycatch species and fisheries, while preserving, or even increasing, target species catch. In this process, one first step is to identify the areas of potential interest to apply spatial management measures by understanding where and when target and bycatch species co-occur. Silky shark (*Carcharhinus falciformis*) is the main shark bycatch species in the tuna purse seine fishery targeting tropical tunas-skipjack (*Katsuwonus pelamis*), yellowfin (*Thunnus albacares*), and bigeye tunas (*Thunnus obesus*) in the tropical Atlantic Ocean. The main objective of this study is to identify areas and periods of time with persistent high silky shark bycatch rates and low target tropical tuna catch rates in the tropical Atlantic Ocean to test their potential to apply dynamic time-area fishery closures. For this, we will use the European Union (French and Spanish) tropical tuna purse seine fishery observer data collected between 2003-2022. The ultimate goal of our analysis is to provide managers with effective spatio-temporal management options so they can evaluate trade-offs between protecting silky sharks by reducing their bycatch in tropical tuna fisheries and ensuring economically viable target fisheries without foregoing catches of target species.

Turning the Tables: Can boarfish become the next sustainable fishery for the Portuguese coast?

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Abstract content: Global fisheries are a cornerstone of worldwide food production. While renewable, world's fish stocks remain a finite resource, with European capture fisheries exhibiting stagnation in the recent years. To ensure sustained profitability in the future, there is a need to explore new avenues for heightened value, diversifying targeted species, and profit optimization within the realm of capture fisheries. The bycatch species represent a compelling prospect for new sources of income for fishers in the future and boarfish can become one of them. Boarfish, a pelagic species with a wide distribution throughout the Northeast Atlantic, is among the 10 most important and abundant species being caught as bycatch in Portugal. Beginning to unlock the potential of boarfish, nutritional analyses revealed its protein and fatty acid richness, rivalling more common species like hake or salmon. Adding to that, sensory evaluations showcased consumers' acceptance of reformulated products obtained from this still overlooked species. However, beyond the palate and the comprehensive analyses of the species' nutritional contents, there is a need to study these species' life-history traits before a targeted fishery is established. Being the first study on this species age and growth for the Portuguese coast, we analysed 463 individuals and set the stage for a standard age estimation protocol to be established. Using whole otoliths as the best method for estimating age, boarfish reached a maximum age of 15 years. Boarfish revealed a biphasic growth pattern, starting with a much faster growth in the first years of life, that slows down at 2.4 years of age, when individuals start to allocate energy for sexual maturation. This finding was corroborated through the implementation of a maturity ogive and analysis of fish size and otolith length relationship. Building on the growing field of Bayesian inference, as a reliable and biologically relevant alternative to estimate growth parameters, this study served as a benchmark for the boarfish population before any exploitation of the species begins on the western coast of Portugal, allowing for future boarfish' stock assessments.

Monitoring the effectiveness of a permanent fishing closure area in the Roses Gulf (NW Mediterranean): the case of *Mullus* spp. as a fisheries management strategy

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Abstract content: The establishment of fishing closure areas have reported positive effects in terms of increasing exploited and non-exploited species abundance and biomass within its boundaries as a consequence of habitat restoration and fishing mortality reduction. Moreover, this management measure can promote benefits on the unprotected adjacent fisheries through the emigration of adult and juvenile individuals, enhancing fisheries yield sustainability. In this context, the study focused on the monitoring of the effectiveness of a fishing closure area within and across its boundaries by evaluating the spatial variability of density and biomass patterns and the existence of spillover after the area was established, in order to evaluate the effect of this management measure in the status of the *Mullus* spp. (*Mullus barbatus* and *Mullus surmuletus*), two main target species of the Catalan fisheries. The protected area was established in the Gulf of Roses (NW Mediterranean), located in the continental shelf at 130-150 m depth on a soft-bottom fishing ground fully exploited by the bottom trawling fleet, and was permanently closed to any fishing activity in 2014 targeting the protection of hake recruits. Experimental trawling hauls were performed inside the closed area and in an adjacent area, where fishing was permitted, to evaluate spatial changes in the composition and structure of the *Mullus* spp. population a short time after the measure was implemented. Moreover, in order to assess spillover effect, the fishing time and *Mullus* spp. total landings and landings per unit of effort (LPUE) were analysed before and after the protection through an experimental design based in buffer zones around the protected area. Results showed higher abundances and biomasses of *Mullus surmuletus* and *Mullus barbatus* inside the closed area, highlighting the presence of larger specimens almost exclusively in the protected area. According to landings data, there was a clear increase of *Mullus* spp. landings and LPUE after the protection. Spatiotemporal variations in LPUE were observed as gradually decreased as distance to closed area border increased and, likewise, LPUE incremented over the years, proving the existence of spillover effect.

Spatio-temporal variation of discard-size ratios of commercial species in NW Mediterranean trawl fisheries: implications for management

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Abstract content: Discards are a major concern for fisheries management, as they affect the sustainability of fish communities. The discard-size ratios of commercial species by the Catalan bottom trawling fleet in NW Mediterranean were analyzed, using data collected on board commercial trawlers from November 2018 to December 2022. The results show that the discard size ratios vary with depth, zone and season. The study focused on the discards of European hake (*Merluccius merluccius*), one of the most overfished species in the area, and explored how they could be reduced by modifying the gear mesh size and the Minimum Conservation Reference Size (MCRS). This study provides useful information on the spatio-temporal patterns of discarded undersize-individuals of commercial species, which can support the improvement of stock assessment models and the design of closure areas to minimize the fishing impact.

Welfare in commercial marine fisheries-Insights from the *CAREFISH/catch* project

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Abstract content: As awareness of animal welfare grows within production systems, the welfare of fish caught in commercial fisheries remains a neglected area. These animals undergo a multitude of stressors from capture to delayed mortality on deck, significantly impacting their welfare. The Carefish-Catch project aims to assess fish welfare across various fishing methods used in coastal fisheries. Investigations are developed in set-nets, purse-seining, pots-and-traps and long-lines, focusing on behavioural indicators, visually assessing welfare using tailored vitality scales, and physiological indicators in samples taken from animals at different stages of the fishing process and vitality stage.

Species cover those most targeted locally by these fisheries, such as sparids in nets and longlines, and small pelagic fish in seines. Preliminary findings indicate varying rates of vitality decline and time to mortality among different species and fishing methods, which are co-related with physiological stress parameters (cortisol, glucose, lactate, osmolality) and with methodological (soaking time, crowding, air exposure, use of ice, hook type) and environmental variables (depth, and water and air temperature, etc). Identification of these correlations allow for improvements in fishing processes. For example data from the set nets, indicate strong trends between both water and air temperature and loss of activity and lactate accumulation, calling for a refinement of the handling, sorting and storage procedures on board, but also between potential soaking time and other physiological indicators, showing room for improvement in the deployment and net recovery process.

By discussing standards for capture, handling, and slaughter procedures, this work aims to foster dialogue on enhancing fish welfare within sustainable fishing frameworks and underscores the intricate relationship between fishing practices and fish welfare, offering pathways for 21st-century fisheries to prioritize both sustainability and animal welfare. It highlights the need for improved stunning and slaughtering methods, particularly for smaller scale fisheries, and suggests integrating research findings into certification schemes for broader impact.

ICATMAR: fisheries continuous and long-term monitoring along the Catalan coast

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Abstract content: The Catalan Institute of Research for the Governance of the Sea (ICATMAR) is a collaboration organ between the Directorate-General for Maritime Policy and Sustainable Fisheries of the Catalan Government and the Institute of Marine Sciences of Barcelona (ICM-CSIC). ICATMAR is carrying out a program to monitor both recreational and commercial fishing, and a program of observation, analysis and prediction of the physical characteristics of the sea along the Catalan coast (NW Mediterranean Sea), with the aim to provide scientific data for best management practices. As for commercial fishing, ICATMAR has been conducting an intensive and continuous monitoring of the fishery resources since 2019. Sampling is carried out on board fishing vessels in the bottom trawling, purse seine and certain small-scale fishing modalities. Data are collected during on-board sampling and samples of target species are taken to the laboratory for further analysis. ICATMAR target species include *Merluccius merluccius*, *Mullus barbatus*, *Sardina pilchardus*, *Engraulis encrasicolus*, *Gymnammodytes cicerelus* and *G. semisquamatus*, among others. However, data are also collected on the rest of ichthyic species of the commercial fraction of the catches and those present in the discards. All the data collected serve as the basis for stock assessment models to determine the status of exploited marine stocks and provide detailed knowledge on the biology of the target species and the characteristics of the communities they inhabit. Additionally, by combining own and external data, different types of reports on fisheries and scientific literature are produced. Furthermore, ICATMAR has developed an online data visualizer (https://icatmar.cat/visors/visor-pesquer/), a scientific knowledge transfer tool containing easily accessible and user-friendly information of the monitoring data that aims to fulfil the needs of the scientific community, administration and civil society to access high-quality data on fisheries. Ultimately, ICATMAR operates at different scales: i) at local level through collaboration with fishers and participation in co-management committees; ii) at regional and national level reporting to the Catalan Government and the General Secretariat of Fisheries of the Spanish Government; iii) at European level through the participation in working groups for the assessment of fisheries stocks at the GFCM and STECF meetings.

Influence of ecological and taxonomical traits on the mineral content of commercial marine species

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Abstract content: Seafood is one of the most traded foods in the world and its consumption is highly recommended as it is a rich source of nutrients and minerals for humans. However, mineral composition in this important food component is often overlooked. With this in mind, our main objective was to compare and provide detailed information on the mineral composition of 96 seafood species from the Northeast Atlantic, while simultaneously providing a better understanding of how ecological and taxonomical traits can shape mineral composition. Our results showed that potassium, phosphorus and sodium were the most abundant macrominerals in the selected species, while zinc, iron, and copper were the most abundant trace elements. More importantly, this study clarified how ecological traits can influence the mineral content of seafood. We found differences in the mineral content regarding taxonomic, feeding mode, and vertical distribution groups, and were attributed to a combination of specific characteristics and physiological requirements, diet composition and bioavailability of minerals in the surrounding environment. Fish were the taxonomic group with the highest mean concentration of potassium, while crustaceans had the highest mean concentrations of calcium and phosphorus. Bivalves had the highest levels of zinc and copper, while gastropods had the highest levels of iron. Regarding the feeding mode, planktivorous species presented the highest value for phosphorus, while omnivorous species presented the highest values for calcium and potassium. Meanwhile, herbivorous species revealed the highest mean concentration for magnesium and selenium. Finally, filter feeders had the highest mean concentrations for sodium, copper, iron, manganese and zinc. In terms of vertical distribution, benthic species presented a clear separation from the other groups, with the highest mean values for most of the elements, namely calcium, magnesium, sodium, copper, iron, manganese, selenium, and zinc. The remaining two elements analysed, potassium and phosphorus, had the highest mean concentration in pelagic species. Element-dense groups were identified according to their mineral content, which can enable better informed choices in human nutrition. This information is important for estimating mineral intakes, assessing mineral requirements, and developing seafood-based food policies and dietary guidelines to overcome nutritional deficits worldwide through seafood consumption.

Mercury bioaccessibility in fish and seafood: effect of method, cooking and trophic level on consumption risk assessment

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Abstract content: Food safety research aims to evaluate the risks of combined human exposure to food-related toxic substances and their combined effects. This work aims to improve the health risk assessment of contaminant transfer from fish and seafood to human consumers, focusing on the determination of the bioaccessibility of Mercury (Hg) through different cooking methods (raw and cooked) on fish (*Aphanopus carbo*; *Thunnus sp*.; *Xiphias gladius*; *Prionace glauca*; *Salmo salar*; *Mytilus sp*.; *Chelon labrosus* and *Scrobicularia plana*). The impact of cooking procedures in Hg bioaccessibility was examined only in *Aphanopus carbo*, and the effect on consumption risk assessment was discussed. The bioaccessible Hg fraction in fish and seafood, which are commonly consumed in the Mediterranean diet, was assessed using three distinct in vitro extraction schemes-Simplified Bioaccessibility Extraction Test (SBET), The Relative *In vitro* Model (RIVM) and the Unified Bioaccessibility Method (UBM). Each extraction method yielded varying results, indicating the absence of a universal methodology for estimating mercury (Hg) bioaccessibility in these matrices. The bioaccessible fractions of Hg ranged from 10% to almost 90% of total mercury (T-Hg). Predator species, such as swordfish (*Xiphias gladius*), Blue Shark (*Prionace glauca*), and tuna (*Thunnus sp*.), had higher bioaccessible fractions. Of the three extractions tested, UBM, provided the highest estimation of Hg bioaccessibility for consumers. The bioaccessible fraction was considerably reduced by the tested cooking procedures (frying, grilling and steaming). Our results indicate that the bioaccessible Hg found in ingested fish and seafood is far below the levels set by current safety risk assessment legislation. These findings emphasise the significance of incorporating bioaccessibility measurements into food safety regulations worldwide.

Pilot study on data collection for reporting marine recreational fishing

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Abstract content: The Catalan Association for Responsible Fishing (ACPR) was created in Catalonia in 1999. It is a non-profit organization that acts in defense of the interests of marine recreational fishing (MRF) users, and in accordance with the administration. The ACPR carries out various tasks with the aim of promoting values and transmitting knowledge and interest in the MRF through collaboration with the scientific community, and environmental education.

In 2022, as part of the development of a Pilot Plan on MRF Science Days, a data collection system was developed to obtain quality information on catches. The system works through a WhatsApp (mobile phone app) that tries to create a database with pictures of fish on an ichthyometer, along with the date and location of the catch. All fish images and location information are sent to a data repository (GoogleDrive) created by the ACPR members and all data transferred to the cloud. The folder is created for each fishing day per fisherman. The information obtained is also recorded per day and per fisherman in a spreadsheet with a link to view the images of the fish caught each day. Fishers who wish to participate in this activity only need to be provided with an ichthyometer, brief instructions, and a telephone number to send the images to at the end of the fishing day. All volunteers are part of another WhatsApp group to exchange information and instructions on data collection. Currently, this plan has evolved into two strategies:

Continued MRF Science Days with more volunteers. Scheduled fishing days for all fishers. The data collection of the catch by the ACPR volunteers, at the moment (23/1/2024), the fishermen report the catch every day they go out fishing, including the day when the catch is zero. At this moment (30/01/2024) there are more than 4.300 fishes in the register, and increasing, and the data are processed by the ICATMAR (ICM, CSIC). This initiative allows interested scientists to explore and analyze these data and establishes a custom for recreational fishermen to report their catches. This data base is an open to all scientists.

Evaluation of deep-sea elasmobranch bycatch in a European crustacean bottom trawler

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Abstract content: Bycatch poses a significant threat to marine ecosystems worldwide, particularly to elasmobranchs whose conservation status is of concern. The southern region of Portugal, notorious for its crustacean bottom trawling activities, faces a pressing problem with an average discard rate of 70%, which includes several deep-sea elasmobranchs (DSE). The aim of this study was to assess the by-catch of DSE along the southern and south-western coasts of Portugal in two different depth strata (< 800 and >800 m). From June 2020 to May 2022, data were collected opportunistically on board a crustacean bottom trawler during 351 hours of fishing effort. In particular, at depths <800 m, the weight of retained catch exceeded that of discarded DSE in both regions. However, at depths >800 m, the discarded weight of DSE approached or slightly exceeded that of the retained catch, highlighting an issue of concern, particularly in the South. A total of 1,559 DSE individuals belonging to 18 species from 5 orders and 9 families were identified, of which 15 species were classified as sharks and 3 as skates. In the South region, where 61 fishing hauls were sampled, DSE were present in 70.5% of the hauls, with *Galeus melastomus* being the most abundant species (47%), with the highest abundance (1.74 n/h) and biomass (0.24 kg/h). In the southwest region, all 16 hauls contained DSE, with Scymnodon ringens being the most abundant (75%) and richest species (1.05 n/h), with one of the highest biomasses (1.81 kg/h), just behind *Dipturus nidarosiensis* (1.99 kg/h). The lowest abundance and biomass belonged to rare (e.g. M*itsukurina owstoni, Oxynotus paradoxus, Chlamydoselachus anguineus*) and endangered species (e.g. *Centrophorus squamosus, Centroscymnus coelolepis, Dalatias licha, Deania calceus*). It is well known that depth is the most important factor in shaping DSE communities and that, despite mandatory discarding, DSE have high mortality rates. In order to protect deep-sea communities and habitats from the impacts of bottom trawling, there is a fishing ban for depths >800 m in European waters, but fishermen continue to fish at these depths. Therefore, our results support the need for improved control and management strategies to prevent DSE bycatch in the first place in order to mitigate the impact of bottom trawling on DSE communities.

Gamete cryopreservation in elasmobranchs using biodegradable capsules

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Abstract content: Elasmobranchs have life strategies that make them highly vulnerable to rapid environmental change, and they are one of the most threatened vertebrate groups on the planet. In parallel with *in situ conservation* tasks, *ex situ* conservation programs can be used to improve the situation of these endangered species. These *ex situ* actions must include the use of assisted reproductive control techniques which, unfortunately, have been scarcely developed in this group, so their usefulness has not been adequately proven. The general goal of this study was to perform the current cryopreservation protocols developed on elasmobranch species by using new alternative biodegradable containers, which have never been used in these species.

The model species used on these trials was the small-spotted catshark (*Scyliorhinus canicula*), that can be regularly found as part of the fishery by-catch. The sperm was collected the day of the experiment and the protocol developed by Salinas et al. (2021) was used to cryopreserved it, mixing 10% of fresh sperm, 90% of elasmobranch extender, and 10% of cryoprotectants (5% of DMSO and methanol, respectively). For cryopreservation process, two different cryovials were tested: 2-mL cryotubes (CT) and 1-mL biodegradable capsules (BC). Sperm motility was assessed both before and after the cryopreservation process. Cryopreserved samples showed significantly lower post-thawing motility values than the fresh samples (which had around 70%). However, we found differences between the different cryovials tested: CT showed better post-thawing motility values (30-35%) than BC (15-20%). Further studies using these biodegradable containers should address the topic of freezing rates, which could improve the final motility of gametes. However, our research can potentially help with the development of artificial insemination projects in elasmobranchs, in which these biodegradable capsules could be introduced directly into females to achieve fertilization success.

The population structure of the axillary seabream (*Pagellus acarne*) in the Portuguese Atlantic coast inferred from body morphometrics and otolith shape analyses

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Abstract content: The axillary seabream (*Pagellus acarne*) is a demersal species widely distributed in the Northeast Atlantic, the Mediterranean and the Black Sea, targeted by artisanal fishermen along the Portuguese mainland coast. The decline in catches observed over the last 20 years, as a result of overfishing, makes it necessary to study the population structures of this species for a rational and sustainable management of the fishery. Understanding whether there is a single or multiple stock(s) is crucial for the conservation of this halieutic resource. In this study, 150 individuals collected between June and September 2023 from three main oceanographic areas (north-west: Matosinhos, south-west: Peniche, and south: Portimão) of the Portuguese mainland were used. Two different but complementary approaches, namely body morphometrics and otolith shape analyses, were used to elucidate its population structure. The contour of the sagittal otoliths was evaluated using elliptic Fourier descriptors (EFD), while the body truss network was used to obtain several anatomical landmark distances (D). To assess the degree of separation between individuals from the three areas, the dataset was tested for significance using univariate and multivariate statistics. Results for the truss network showed significant differences between, at least, two of the regions for 15 out of 23 D. Notably, the shape analysis results showed significant differences for 10 of the 24 EFD. Using a jackknifed matrix, the D achieved a moderate overall reclassification rate of 59%, while the EFD achieved a similar reclassification rate of only 55%. However, the combination of the two methods (EFD+D) slightly increased the overall reclassification rate to 67%. These results and the overall moderate reclassification rate indicate the existence of a single stock, although not necessarily a homogeneous one. Small regional differences between areas are most likely due to differences in local environmental factors. These data suggest for the first time that the species in the study area is a single but potentially heterogeneous stock, with important implications for the adequate fisheries management.

Gauging stations and fish passage: a finally happy forced marriage

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Abstract content: Gauging weirs are hydraulic structures that provide precise information on river discharge, crucial for effective water resource management. One of the most common devices worldwide is small low head ramped weirs. Nevertheless, depending on the weir height, river morphology, and flow discharge, they can act as velocity barriers, diminishing or hindering fish upstream movements. This study aims to assess fish passage over gauging weirs by establishing a link between fish passage success and different hydraulic scenarios. To achieve this, a binary predictive success model was developed, with the brown trout (*Salmo trutta*) as target species. Radio-tracking was used to assess the passage success of 110 trout in two gauging stations within the Oria River basin. Utilizing discharge data from the gauging stations and hydraulic variables (water levels upstream and downstream of the gauging station) recorded through ultrasound water level sensors (MS Ultra®). Additional hydrodynamic variables were obtained through the calibration of 3D hydraulic models with OpenFOAM. This model simulated all possible scenarios and provided comprehensive data about the flow and velocity field depth. The combination of 3D model results and recorded biological performance outlines specific river conditions and weir dimensions favorable for the ascent of brown trout along the studied flat-V ramped weirs. This knowledge directly influences the design, assessment, and retrofitting of velocity barriers, ensuring compatibility with fish migration.

Exploring the impacts of diversion canals on Iberian fish: preliminary insights

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Abstract content: Diversion canals, crucial for irrigation and hydroelectric production, have been identified as a potential source of fish loss, leading to significant impacts on fish populations. While extensively studied in some regions of the world, research on this topic remains limited in the Iberian Peninsula. To fill this gap, a consortium consisting of GEA-Ecohydraulics and the Confederación Hidrográfica del Duero on the one hand, and the Life Kantauribai project on the other, was formed to conduct further research into this topic. Our research comprises a comprehensive literature review, investigating both the impacts of diversion canals on fish populations and potential mitigation solutions. It also includes the analysis of existing sampling data from fish surveys in canals. Additionally, we have ongoing field experiments in canals of the Duero and Bidasoa rivers. In these pilot samplings, we evaluate the possible loss of potamodromous fish species in different channel types (temporary vs. permanent, earth vs. concrete canals), and telemetry experiments are underway to assess critical aspects, such as fish entry into canals, potential exit routes, and any possible associated mortalities. The research outcomes are expected to reveal the impacts of diversion canals and their implications for the downstream migration of Iberian fish species. Moreover, the study aims to identify the species most adversely affected and determine the most effective solutions to mitigate these impacts. The findings will contribute significantly to the development of strategies for river system management and the protection of fish. Ultimately, the results hold the potential to enhance the design and operation of diversion canals, minimizing their impact on fish populations.

Categorization of the capacity of dispersal of Spanish native freshwater fish for the ConnectFish project

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Abstract content: Fluvial ecosystems are characterized by their hierarchical structure and directional flow. The aquatic organisms that inhabit them are constrained to the limits of the network, making them vulnerable to changes occurring upstream. Barriers and obstacles interrupt river longitudinal connectivity, modifying the natural flow regime and impeding the passage of matter and energy. Among all the negative effects that barriers cause in rivers, perhaps the most obvious is that they hinder movement between segments. This is especially harmful for diadromous fish, although it is also believed to have an impact on potamodromous species that migrate within the river. ConnectFish is a project that aims to analyse the impact that these barriers have on Spanish native freshwater fish species. One of the first actions undertaken within this project has been the compilation of data from these species in order to estimate their capacity of dispersal, and hence, to what extent they are affected by the loss of longitudinal connectivity. The gathered data includes taxonomic and morphometric variables, along with traits related to movement capacity and swimming performance. The data were obtained from FishBase (https://fishbase.org), the Spanish Fish Chart (CPE http://www.cartapiscicola.es), FISHMORPH (https://doi.org/10.6084/m9.figshare.14891412) and a literature search in the Web of Science database. The data obtained from FishBase, FISHMORPH and CPE was fairly complete. This was unfortunately not the case for swimming performance and movement variables, although data was collected for 17 and 15 Spanish species, respectively. Species lacking information were given available data from other species of the genus. A factorial analysis for mixed data (FAMD) was performed with the species that had a complete set of data (n=21), and the rest (n=28) were projected on the resulting dimensional space. To check the results and help with interpretation, a scale was built according to expert advice, from least to most mobile fish. The most mobile fishes included the sturgeon (*Acipenser sturio* Linnaeus 1758) and the sea lamprey (*Petromyzon marinus* Linnaeus 1758) while the least mobile ones were the freshwater blenny (*Salariopsis fluviatilis* Asso y del Rio 1801) and the Adour sculpin (*Cottus aturi* Freyhof, Kottelat & Nolte 2005).

Understanding marine fish connectivity and habitat use to implement ecosystem-based management

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Abstract content: A current challenge for marine conservation is incorporating connectivity into fisheries and spatial (MPAs) management plans. For this, it is necessary to understand the spatial and habitat use of the different species with different life histories and connectivity patterns to combine efficient fisheries and spatial measures for a better conservation of marine ecosystems and to ensure the sustainable exploitation of the oceans. The European project Poctefa RESMED was developed in the marine coastline of the Eastern Pyrenees (NW Mediterranean Sea), including French and Spanish territory and several MPAs (Banyuls, Cap de Creus, and Medes) separated by tens of kilometers, with the objective of understanding the movement and habitat use of species with different life histories to design new management measures on a regional transboundary scale. A total of 300 individuals of 25 different species were tagged, including benthic and bento-pelagic species, and their movement was studied in an array of 100 receivers deployed along a coastline of more than 100 linear km, and using a detailed mapping of the marine habitats of this area. The results showed several movement strategies of species related to their life history, ranging from sedentary patterns to displacements of hundreds of kilometers, demonstrating the effective connectivity between the MPAs along the Spanish and French coasts. In addition, we identified feeding and breeding areas for some species and habitats used as migratory corridors, such as estuarine seagrass beds. Our results show a mismatch between the scales of spatial management (MPAs of a few kilometers across) and the scales of the real ecological functioning in the study area (across tens of kilometers). Thus, we should combine spatial management with fisheries measures integrating ecological connectivity into management programs, increase the spatial scales at which management operates, and consider this large area as an ecological unit and an effective MPA network. These measures should be unified and agreed upon between different MPAs, open fishing areas, and transboundary countries.

Freshwater incursions of European sea bass in the Tagus river: an overlooked issue in European rivers?

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Abstract content: The European sea bass (*Dicentrarchus labrax* (Linnaeus, 1758)) is an euryhaline and marine migrant species that is known for spawning at sea and relies on transitional habitats like coastal lagoons and estuaries as nursery and feeding grounds. The species is considered a partial migrant due to the co-existence of distinct migratory phenotypes, encompassing long-distance migrations towards wintering grounds and residency behavior in coastal habitats. Although juveniles are known to use estuaries and occasionally move to freshwater environments, the occurrence of sea bass adults in freshwater environments was only recently reported in Tagus River (Portugal). This behaviour is common amongst other Moronidae species, but was unknown for sea bass until recently. Along the Tagus River, adult sea bass were caught by fishermen up to 150 km from the river mouth and 80 km from the tidal limit, close to the Abrantes weir, the first barrier of Tagus river in the main section. Sea bass individuals captured immediately downstream of the weir (66 individuals), between 2021 and 2022, ranged between 29cm-60cm in total length, 223g-1837g in total weight, and were aged between 1 and 6 years old, according to the annuli identified in the scales. While a clear predominance of juveniles was observed, the results confirms the occurrence of sub-adults and adults in freshwater habitats. Although sea bass are occasionally captured throughout the year, fishers reported increased occurrences of the species in freshwater during spring and summer and less frequent captures during the spawning season (December-April). Multidisciplinary ongoing studies combining biotelemetry, genetics and otolith chemistry, will allow to further unravel freshwater migrations of this highly valuable species, targeted by both commercial and recreational fisheries. Understanding the species migratory patterns is crucial to ensure efficient fisheries management and the conservation of the species freshwater contingent.

Restoration of fish migration and beginning of an European sturgeon recovery project in the lower Ebre river (Catalonia) and beyond

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Abstract content: The LIFE MIGRATOEBRE project (2015-2024; www.migratoebre.eu) aimed to improve fish migration in the lower Ebre river (Catalonia), mostly focused on *Anguilla anguilla*, *Alosa fallax*, *Petromyzon marinus* and *Acipenser sturio* conservation and recovery. Several mitigation measures have been executed, such as the construction of several fish passage projects (at Ascó and Xerta weirs). Various studies (such as mapping of aquatic habitats) and a regular monitoring (water quality, fish populations) has been done. Between 2017 and 2020, 150 fish (10 *Chelon ramada*, 13 *Chelon labrosus*, 21 *Mugil cephalus*, 45 *A. fallax* and 61 A. *anguilla*) were monitored by acoustic telemetry (following Le Pichon et al., 2015). To reinforce this information, in autumn 2023 44 juveniles of *A. sturio* transported from Saint Seurin-sur-l'Isle (Nouvelle Aquitaine, France) were also marked and released in the lower Ebre river. Obtained results indicate that Ebre river allows the recovery for those endangered species. From now on, it is planned to develop a restoration plan for the species in the Iberian Peninsula, based on the Action Plan for the conservation and restoration of the European sturgeon (Rosenthal et al., 2010) and on the Technical Guidelines for the development of reintroduction programs of wild species in Spain (MAGRAMA, 2013). This work was funded by the LIFE MIGRATOEBRE Project (LIFE13 NAT/ES/000237; 2014/07/01-2024/06/03), the Institute for the Development of the Ebre Regions (IDECE), and the Catalunya-La Pedrera Foundation. It also received support from the Research Unit EABX-Aquatic ecosystems and global changes from INRAE Nouvelle-Aquitaine-Bordeaux.

Follow-up by ultrasonic telemetry of the pilot release of 44 juvenile European sturgeon (*Acipenser sturio*) in the final stretch of the Ebre River in Catalonia (NE Iberian Peninsula)

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Abstract content: The sturgeon species of the family *Acipenseridae* are red-listed by the IUCN and are more threatened than any other group of species globally (IUCN 2010). Currently, the only confirmed population of European sturgeon (*Acipenser sturio*) in the wild is restricted to the Garonne and Dordogne rivers (Nouvelle Aquitaine, France), and since 2007, it has been reinforced with specimens bred in captivity at the French experimentation center in Saint Seurin-sur-l'Isle. From this experimental station, reintroduction programs are being initiated in other countries where the European sturgeon once existed, such as the Netherlands, in the Rhine River, and in Germany, the Elbe River. Therefore, the LIFE MIGRATOEBRE project (2015-2024; www.migratoebre.eu) aims to participate in this international cooperation for the conservation and restoration of the European sturgeon. It has contributed with the release of 44 juvenile *A. sturio* in the final stretch of the Ebre River between the Xerta-Tivenys weir and the river mouth, in a distance of approximately 56 km. These one-and-a-half-year-old sturgeons came from the Saint Seurin-sur-l'Isle station, have been marked for monitoring using ultrasonic telemetry. The main objective is to observe their behaviour in the lower Ebre River. The release took place on December 21, 2023, and data from receivers located along the river have been collected for the following five months. This preliminary study lays the groundwork for a potential reintroduction of this fish in the Mediterranean Sea, where it was once widely distributed.

Situation of river connectivity for fish in the rivers of Girona

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Abstract content: The area of confluence of the Ter, Llémena, Onyar, Galligans and Güell rivers, and other smaller river courses, in the municipality of Girona and some neighboring municipalities, constitutes a river sector of very high interest for the conservation of the original fish fauna. of the rivers of Catalonia. Five species of native fish are still found here, or again, all of them threatened and/or catalogued at the European or Catalan level. They are the eel (*Anguilla anguilla*), the Three-spined stickleback (*Gasterosteus aculeatus*), the Freshwater blenny (*Salaria fluviatilis*), the Mediterranean barbel (*Barbus meridionalis*) and the Catalan chub (*Squalius laietanus*). These are all the native species potentially present in these bodies of water. Unfortunately, today it is exceptional to achieve such a high level of integrity of the original fish population. However, as in most Iberian rivers, the regular presence of up to 14 exotic species is currently also recorded. The presence of artificial barriers, impermeable for fish, also constitutes here one of the main challenges for the conservation of ichthyofauna, as well as for achieving the objectives of the WFD (Directive 2000/60/EC). In 2014, we carried out a global diagnosis of the river connectivity situation in the area, which was recently updated. Existing barriers were located and analysed, evaluating their permeability through the application of a standardized methodology (ICF Index) and expert criteria. In addition, a solution prioritization was established by point. In this sector, up to 26 artificial barriers have been located, of very diverse types. Only 8 of these barriers have an acceptable permeability level for fish (VERY GOOD and GOOD ICF levels). In the rest of the barriers, it is necessary to act, either through 1) demolition, 2) demolition and reconstruction of permeable solutions, or, at least, 3) construction of river connectors. So far, only two of these points have been acted upon, through the construction of two fish ramps. There are already projects for at least two other important barriers. Within the framework of the GiroNat project, financed by Fundación Biodiversidad, the execution of some of these projects is contemplated.

Do *Mugil liza* leave the nursery grounds ahead the schedule?

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Abstract content: The Lebranche mullet *(Mugil liza*) supports an important pelagic fishery in the southeast-south Brazil. The species is believed to stay until 5 years old within the coastal lagoons that serve as nursery grounds until they reach gonadal maturity and leave to spawn at sea. However, knowledge about early migratory movements between coastal lagoons is still lacking. In order to unravel such movements of *M. liza*, 12 juvenile individuals (one to four-year-old fish) and 3 adult individuals (six-year-old fish) were collected in April 2022 in three nursery grounds in Santa Catarina, south Brazil [Babitonga Bay (BB), Baía Norte (BN) and Ibiraquera lagoon (IL)]. Multi-elemental lifetime signatures from core-to-edge otolith transects were determined using laser ablation inductively coupled plasma mass spectrometry. Lifetime chemical history was placed in time, according to the age determination and combined to environmental data obtained from the historical records from weather stations near to each coastal lagoon. A distance-based redundancy analysis found that wind speed, wind gusts, pressure, humidity and precipitation were significantly different across regions. Lifetime otolith chemical signatures exhibited distinct regional patterns, mainly driven by differences in Ba/Ca, Fe/Ca, Mn/Ca, and Sr/Ca. Combining environmental variable and data with multi-elemental signatures, the leave-one-out reclassification reassigned the individuals to their areas of origin with a high accuracy (100%, 100% and 99% for BB, BN and IL, respectively). The results indicate a spatial isolation for the three coastal lagoons with a minimum degree of intermixing. Indeed, Ba/Ca and Sr/Ca otolith transects indicated that juvenile of *M. liza* do not leave the lagoon nursery grounds until they reached sexual maturity, when they are four years old. The data suggest that these nursery grounds should be considered as separated areas for fisheries management purposes.

Environmental salinity modulates olfactory sensitivity in the euryhaline European seabass, *Dicentrarchus labrax*

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Abstract content: The olfactory epithelium of fish is-of necessity-in intimate contact with the surrounding water. In euryhaline fish, movement from seawater to freshwater (and vice versa) exposes the epithelium to massive changes in salinity and ionic concentrations. The European seabass carries out large movements from the ocean into estuaries and up rivers to regions in complete freshwater. In this process it adjusts its osmoregulatory physiology to cope with changes in ions and water movements and maintain hydration and fluid and cellular ionic homeostasis. However other physiological functions may also be affected by environmental salinity. How does the olfactory system function in the face of such changes?

The current study compared olfactory sensitivity in seawater-(35‰) and brackish water-adapted seabass (5‰) using extracellular multi-unit recording from the olfactory nerve. Seawater-adapted bass had higher olfactory sensitivity to amino acid odorants when delivered in seawater than in freshwater. Conversely, brackish water-adapted bass had largely similar sensitivities to the same odorants when delivered in seawater or freshwater, although sensitivity was still slightly higher in seawater. The olfactory system of seawater-adapted bass was sensitive to decreases in external [Ca^{2+}], whereas brackish water-adapted bass responded to increases in [Ca^{2+}]; both seawater- and brackish water-adapted bass responded to increases in external [Na^{+}] but the sensitivity was markedly higher in brackish water-adapted bass. In seawater-adapted bass, olfactory sensitivity to l-alanine depended on external Ca^{2+} ions, but not Na^{+}; brackish water-adapted bass did respond to l-alanine in the absence of Ca^{2+}, albeit with lower sensitivity, whereas sensitivity was unaffected by removal of Na^{+} ions. A possible adaptation of the olfactory epithelium was the higher number of mucous cells in brackish water-adapted bass. The olfactory system of seabass is able to adapt to low salinities, but this is not immediate. Considering the vital importance of olfaction in fish survival, this adaptation of the olfactory system to low salinity represents an important feature in the capacity to explore environments of different salinities, although bass entering estuarine water of lower salinity would have reduced olfactory sensitivity in the short term. Further studies are needed to deepen our understanding of the mechanisms involved in the adaptation.

New and recent records of fishes from the Mariana Islands

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Abstract content: The most recent checklist of fishes of the Mariana Islands lists 1,106 species including 1,020 that are inshore or epipelagic, the vast majority of which inhabit coral reefs Included in the list are 97 species indicated as new records without further comment other than to identify the basis of the record as an examined or collected specimen (21), photograph (57) or reliable sighting (16) and at least 16 additional species identified only to genus, 13 of which have since been described as new. In light of a growing body of research that extends the occurrences of many shore fishes to depths below 300 m as well as other species of shore fish lineages that may occur exclusively below the mesophotic zone, we expand our use of the terms reef fishes, inshore fishes or shore fishes to include the rariphotic zone, as well as even deeper-dwelling species that inhabit these zones at higher latitudes. Based on this, we include at least 116 additional species that have recently been discovered in the Mariana Islands that occur or are likely to occur at depths of approximately 500 m or less. but many have not. Here, we consolidate into a single publication, photographs and other information that represent new records of inshore and epipelagic fishes, or that validate previously documented occurrences of them within the Mariana Islands and associated banks and seamounts.

Tell me how you smell and I'll tell you who you are. Studying odour mate recognition systems in deep-sea fish (*Notacanthus* sp.)

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Abstract content: Deep-sea ecosystems are natural laboratories for investigating the interplay between the environment and living organisms, due to their extreme conditions that lead to novel adaptations. One of these key interactions is how organisms obtain and process information from the environment, which is crucial for a set of essential activities, obtaining food, evading predators, mating, indispensable for their survival. Here, we present the first attempt to characterise the olfactory systems in deep-sea fishes (*Notacanthus* sp.). Notacanthids are demersal deep-sea fishes characterised by a highly conservative morphology, leptocephalus larvae and a specialised diet based on in sessile and/or low mobility invertebrates (brittle stars, sponges, corals), which are an essential component of the fish communities on continental slopes worldwide. Molecular data (comparative genomics and transcriptomics) will be used to test several hypotheses regarding the life cycle, ecology, and biology of notacanthid species e.g.: the use of olfaction by males for mating. To this end, the first genome assembly of a Notacanthidae species is produced from the recently described species *Notacanthus arrontei*. In addition, RNA-seq data were generated from the brain and nostril of several individuals (males and females) of two *Notacanthus* species (*N. arrontei and N. bonaparte*). These datasets are used here to conduct Differential Gene Expression (DGE), aiming to identify the genes and metabolic pathways involved in olfactory mate recognition within both species. Furthermore, by determining the contrasting patterns between the two species (i.e., DGE and gene repertoire), we aim to gain insights into the specific olfactory receptors involved in mate recognition and their role in the speciation processes within Notacanthidae family.

Patterns of gene expression of an euryhaline fish species, *Aphanius iberus*, living at different salinity levels

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Abstract content: Salinity is a crucial ecological factor in aquatic environments and plays a significant role in the adaptation, survival, and development of fish species. While some fish can survive for short periods in freshwater, brackish and saltwater habitats, others are truly euryhaline and can thrive in all types of habitats. Euryhaline fish can adapt rapidly to significant changes in salinity, despite the great physiological challenges posed by these environments. The Spanish toothcarp, *Aphanius iberus* (Valenciennes, 1846), is one of these exceptional species that has successfully adapted to thrive in habitats with widely different salinity along the eastern coast of the Iberian Peninsula, one of the most degraded areas in Spain. These habitats range from groundwater springs (locally known as ullals), to coastal lagoons and river mouths, to even salt marshes. Despite this remarkable resilience and adaptability, we know very little about the molecular mechanisms, functional genes, traits under selection and pathways related to osmoregulation that allow *A. iberus* to adapt to different environments. Here, we used RNA-Seq to identify candidate genes and traits under selection involved in adaptation and osmoregulation in natural populations of *A. iberus* inhabiting environments ranging from freshwater (0 ppt) to intermediate brackish water (15-20 ppt) to an extremely salty marsh (~50 ppt). We extracted RNA from two different tissues, gills and digestive tract, which are known to play a crucial role in osmoregulation and performed differential gene expression analyses comparing 4 replicates from each population to identify genes upregulated in each salinity condition. The findings of this study will make a significant contribution to the understanding of adaptation processes in this highly endangered endemic species and the mechanisms involved in osmophysiology and adaptation to rapidly changing environments in the eastern Spanish coast in the context of ongoing global warming context.

Environmental DNA as an effective tool for the study and conservation of the Sarda (*Achondrostoma salmantinum*) (Actinopterygii, Leuciscidae)

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Abstract content: Result of a complex geomorphological history since the Tertiary, the ichthyofauna of the Duero river is characterized by the presence of very ancient species, most of them endemic. Among these, the sarda (*Achondrostoma salmantinum* Doadrio & Elvira, 2007) is among the most threatened species in the Iberian Peninsula, because of the great transformation that rivers, where it inhabits in the southwestern region of the Duero, have undergone. This situation is attributed to the creation of hydraulic infrastructures, the introduction of invasive species, and the exploitation of water resources in a context of global warming. Despite the small distribution area occupied by the species, from a genetic point of view, sarda shows high intraspecific genetic structuring, denoting the great evolutionary relevance of its populations. This study investigated the potential of environmental DNA as an effective tool for monitoring the presence of sarda in its distribution area. For this purpose, the locations where the species is currently found and those where it has not been cited in the last decade were sampled. qPCR and metabarcoding analyses using a fragment of the mitochondrial gene 12S have allowed us to know not only the presence and conservation status of the sarda but also the community of fish accompanying this species. Previous studies have already demonstrated the sensitivity of environmental DNA techniques to detect and identify the ichthyofauna of the Duero, especially in the case of those most vulnerable species.

Tailoring eDNA methodologies for enhanced species detection: a case study on the endangered *Anaecypris hispanica*

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Abstract content: Intensive human activities are driving population declines and biodiversity loss. Species monitoring is crucial for assessing extinction risk but is traditionally reliant on direct observations. Technological advancements, particularly environmental DNA (eDNA)-based methods, offer non-invasive, highly sensitive alternatives for species detection. Yet, standardization in technical eDNA protocols remains lacking. For instance, when analysing water samples with varying organic content, false negatives may occur in eutrophic waters due to high PCR inhibitor levels and in oligotrophic waters due to low DNA concentration. Here, we investigated how a simple protocol adjustment, such as altering the input volume of the sample in the molecular essay, can influence species detection. We focused on the assessment of the current distribution of *Anaecypris hispanica* (Steindachner,1866) in Portugal. This Iberian endemism, restricted to the Guadiana and Guadalquivir drainages is listed as endangered in Portuguese waters. Water samples were collected, filtered, and analysed using qPCR assays at different eDNA concentrations (standard, dilution, increased concentration). Species occurrence maps were generated for each concentration tested and for all positive sites combined. Based on these maps, we estimated metrics often included in regional species extinction risk assessments, illustrating potential implications for species conservation. Our results showed that eDNA concentration influenced both the overall number of positive detections for the study area and importantly, which locations yielded positive. Differences amongst sites are likely linked to some variation in water quality, namely in organic matter content. This highlights the benefits of testing different input volume of sample and hints to the potential prevalence of false negatives obtained if a single, fixed eDNA concentration is used. Overall, we successfully detected *A. hispanica* in all ten Portuguese sub-basins where it occurred at the end of the last century, including those sub-basins where it had not been observed in almost two decades. This study shows the effectiveness of eDNA methods in providing comprehensive species distribution data crucial for effective conservation actions, and that the choice of laboratory protocols might significantly affect distribution data and extinction risk assessment metrics driven from these data. Hence, it might be advisable to include testing variable eDNA concentrations to enhance detection rates.

Genetic characterization of the chub (*Squalius* sp.) populations in Catalan basins (Northeastern Iberian Peninsula)

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Abstract content: Until 2007, chub populations from the Ebro River northward to the Agly River in France, were considered *Squalius cephalus* or European chub. More recently the *Squalius* inhabiting these rivers were identified as a new distinct endemic chub species, *S. laietanus* or Catalan chub (Doadrio et al. 2007). Hybridization between *S. laietanus* and *S. cephalus* has been documented in the Massane and Angly rivers in France. Consequently, since 2019, *S. laietanus* is listed as an endangered species in France. This study aims to determine whether the *S. laietanus* populations south of the Pyrenees are threatened by the presence of *S. cephalus* specimens. A total of 846 chub individuals from ten different basins, spanning from the Muga River to the Ebro River, were collected and characterized by barcoding using the mitochondrial gene Cytochrome Oxidase I (COI). According to the COI marker, *S. laietanus* is the most abundant species in Catalonian basins, occurring in 47 out of 54 sampling locations. The European chub, *S. cephalus* was detected in 20 locations across 4 river basins: the Muga, Besòs, Llobregat, and Ebro Rivers. In 14 of these 20 locations, both species are sympatric and, the European chub was the sole species detected in six locations in the Llobregat and Ebro Rivers. In the Canaletes stream, a tributary of the Ebro River, all the collected individuals were identified as *S. pyrenaicus* or Iberian chub. In the light of these findings and considering the reports on hybridization in French basins, concerns arise about the genetic integrity of *S. laietanus* in the analyzed basins where the two species coexist. Ongoing analyses utilizing the nuclear gene RAG1 suggest putative hybrids in some of the studied locations.

Phylogeography of the West North African species of the tetraploid fish genus *Luciobarbus* Heckel, 1843 (Actinopterygii, Cyprinidae)

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Abstract content: The Strait of Gibraltar has played a significant role in shaping the biodiversity and historical biogeography of various organisms, particularly aquatic species. Geomorphological changes in the region have resulted in the drying and refilling of the Mediterranean Sea during the Cenozoic era. These drastic changes are believed to have occurred in the Mio-Pliocene, influenced by climatic shifts associated with alterations in marine current circulation. These events have likely impacted the genetic diversity and population structure of endemic freshwater fish species around the Strait of Gibraltar. However, the genus *Luciobarbus*, which exhibits the highest diversity in this region, has mainly been studied using mitochondrial DNA due to the challenges involved in analyzing populations of allotetraploid species. In this study, we aimed to test the hypothesis regarding the influence of geographic and climatic changes on the structure and diversity of populations of freshwater fishes in North Africa by investigating mitochondrial gene variation and utilizing a set of 18 newly designed microsatellite loci across six *Luciobarbus* species and multiple populations in North Africa. Our analysis revealed the presence of two species groups and confirmed the monophyly of all species and populations located west of North Africa respect to *L. lanigarensis* and *L. yahyaouii* found in drainages flowing to the eastern Mediterranean slope. The diversification of these species likely occurred during the Pliocene, with some populations exhibiting reduced genetic variability due to historical factors and increased desertification in the region.

Genomic diversity of brown trout populations along a small Mediterranean river

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Abstract content: The Ter River basin (3000 Km^2) is located the Northeastern extreme of the Iberian Peninsula. As in other short Mediterranean rivers, brown trout (*Salmo trutta* L.) uniquely inhabits in the headstreams. Studies based on allozyme variation, performed at the end of the last century, identified native trout populations at the uppermost locations of the Ter and the Freser rivers, the main tributary of the Ter headwater. However, in 2004, non-native trout of hatchery origin were detected in some stretches of the Freser River within a brown trout genetic refuge area. Using a 2bRADseq approach, this study analyzed the genomic diversity of brown trout within and among populations along the Ter and Freser rivers. The sampling included 269 wild fish from 12 locations and 39 non-native hatchery fish used in the regional stocking activities. The uppermost wild locations were sampled twice, in 2004 and 2014, and the hatchery stock in 2002 and 2014. After the informatic pipeline, the final data set comprised 18,425 nuclear SNPs mapped along the 40 assembled chromosomes of the brown trout genome, with a 10.5x (±2.5x) coverage per locus. Hatchery ancestry was confirmed in eight of the 12 wild locations as suggested by previous analyses using the diagnostic *LDH-C1** locus, but the genomic analyses identified traces of hatchery ancestry in three additional locations. Only the uppermost location of the Ter River basin preserved its native ancestry from 2004 to 2014. In this location, genetic diversity measured as polymorphic SNPs and observed (Ho) and expected heterozygosity (He) were 4.430, 0.074 and 0.072, respectively; but increased to levels observed in the hatchery stock (12.804, 0.175 and 0.160) in locations where the estimated impact was higher than 10%. Population structure analyses showed the distinction between the Ter and Freser trout. Genomic singularities in some tributaries suggested the isolation of trout populations even at short hydrographical distances without clear dispersal barriers. The analyses also indicated that the dispersion of wild fish with hatchery ancestry is disturbing the ancestral genomic population structure due to the spread of hatchery alleles along the basin. A recent reduction in the effective population size was estimated for these populations.

Evaluation of environmental DNA as a tool for early detection of invasive species in Catalonia

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Abstract content: Invasive species are one of the main threats to freshwater ecosystems. Their early detection is crucial for early eradication and prevention of establishment. Regular sampling is costly, it can render an impact on ecosystems and communities and is limited to specific habitats. Recent technological advances have shown that environmental DNA metabarcoding (eDNA) is a powerful and promising tool that can complement regular sampling and help in early detection of invasive species. In this study we aimed at using eDNA to detect invasive species (mainly of fish) in rivers, lakes and reservoirs of Catalonia and compare it with catch per unit effort results from the same sites. For that purpose, we sampled 25 localities from lowland rivers (Ter, Tordera, Onyar, Terri, Daró and their tributaries), wetlands (e.g. estany de Sils and Ter Vell), two reservoirs (Susqueda and Boadella) and one karstic lake (Banyoles). In each location, two replicates were obtained by filtering between 5 and 74 L of water per replicate. Samples were extracted in a clean lab especially dedicated to eDNA extraction with positive pressure and amplified with a primer targeting the mitochondrial 12S rRNA gene (Mifish) in triplicates. Sequencing was performed with an Illumina Novaseq X plus with an average of 400.000 reads per sample. Overall, we detected over 120 genera of which more than 60% were fish, ~20% mammals, 9% birds, 6% amphibians and less than 3% reptiles. There was a higher proportion of fish species which were non-native to Catalonia, although not all of them were abundant in terms of the relative proportion of reads per sample. The method showed to have a very high capacity for early detection of invasive species. We suggest to use eDNA sampling extensively to have an overall map of the conservation status of the freshwater habitats of Catalonia.

Preliminary findings of small-scale genetic differentiation and diversity of Mediterranean brown trout from the Ebro River basin

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Abstract content: Brown trout populations exhibit complex patterns of genetic differentiation at micro to macrogeographical scales, harbouring Southern Europe a large portion of the species' genetic diversity and a high genetic structuring. Brown trout is the only salmonid native to the Mediterranean Iberian region and the most managed species for recreational fishing. Unfortunately, such a valuable natural resource is intensely threatened by some anthropogenic drivers and pressures. The loss of river connectivity, coupled with rising water temperatures and reduced flows, is negatively affecting these rear-edge populations, resulting in a decline in genetic diversity. There is a gap in understanding how landscape connectivity and structure at a microgeographical scale influence spatial diversity patterns and introgression rates amidst ongoing climate change. Most studies of Iberian brown trout have focused on Atlantic basins, with little information from Mediterranean populations. We present some preliminary results of a comprehensive study of foreign introgression, genetic diversity and structure in brown trout populations from 46 rivers belonging to Ebro, Turia, Mijares and Júcar river basins, based on mitochondrial and nuclear DNA markers. The genetic variability in the area is a complex picture, given the presence of two native Mediterranean mitochondrial lineages (Adriatic and Mediterranean) and varied frequencies of foreign genotypes and introgression levels. Here, we analysed the geographical distribution of the genetic variability in some populations from the Ebro River basin, using 12 microsatellite loci. This preliminary study includes 23 sampling sites along altitudinal gradients from rivers Gállego and Cinca (Pyrenees), and Jalón and Guadalope (Iberian System). When compared to other Atlantic and Mediterranean Iberian populations, heterozygosity levels were rather lower. Allelic richness was higher than in other Mediterranean Iberian populations, showing similar values of genetic differentiation between sites. Demographic history analyses revealed that more than half of the locations showed effective population sizes below the limit required to elude inbreeding depression. Although some populations are in good conservation status, our preliminary findings indicate that many of them would be at risk of suffering genetic drift and inbreeding. This highlights the need for urgent action to conserve this valuable resource in the face of unpredictable global change.

Genomic and ecological differentiation of a highly threatened elasmobranch: the Pacific Angel Shark, *Squatina californica*

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Abstract content: Genetic divergence between populations of marine species with moderate to high dispersal capacities is generally associated with vicariant events and/or environmental heterogeneity. An interesting region for evaluating these effects is the Mexican Northeastern Pacific, where the complex geological activity associated with the formation of the Gulf of California has promoted diversification processes in many taxa. One of the most representative species of the region is *Squatina californica* (Ayres, 1859), the only species of Angel Shark described for the Northeast Pacific. Morphological and reproductive studies have found differences between individuals from the Gulf of California (GC) and the west coast of Baja California (PC), which suggests that the recent exchange between both regions along the coasts of the extreme south of the peninsula is low or non-existing. Additionally, the temporal and spatial oceanographic variations characterizing the GC suggests the existence of isolated populations, as has already been reported in other benthic elasmobranchs. Here, we employed reduced representation genome sequencing (3RADs) and potential species distribution modelling to evaluate the effect of environmental variation and vicariance on the differentiation of *S. californica* populations. We detected that the species is structured into two genetically and ecologically differentiated groups which correspond to populations of GC and PC, and we found a lack of current genetic flow between both areas. Additionally, we detected a substructure within the GC (peninsular *vs* continental population) probably caused by the deep of sea bottom associated with the San Andres fault and by the temperature regime that characterizes the GC. These results show the existence of at least two evolutionary units (GC and PC) that require special conservation attention since the species is classified according to the IUCN as vulnerable and represents an important component in the region's fisheries.

Causes of population structure in brown trout, Salmo trutta, from the Pedroso River (Duero basin, Spain)

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Abstract content: In brown trout, *Salmo trutta*, population structure is the result of a combination of factors such as the geographic distance, the altitude, the hierarchy of the hydrography and the presence of physical barriers totally or partially impassable for trout. Structure can even occur within populations, because of the lack of random mating (panmixia) between individuals, which is often a consequence of stocking with exogenous fish. The knowledge of all these aspects is important to determine the conservation status of native trout populations and to design management strategies since both the isolation of populations and stocking lead to a loss of genetic diversity that makes populations vulnerable. In this study, six brown trout populations of the Pedroso river (Duero basin) were genetically characterized by eight microsatellite loci, with the aim to identify factors determining population structure. Our results indicated a significant isolation of populations in the headwaters, which exhibited low genetic diversity, a small effective population size and a high rate of inbreeding. In the rest of the river, the population structure showed mostly a pattern of isolation by distance, with larger effective population sizes and lower inbreeding. We also found a substructure in one of the localities analysed downstream (PE2), because all the 0+ class individuals captured were genetically very different from the rest of the trout from this location. Genetic analysis confirmed that these rare individuals come from the hatchery stock used to stocking Pedroso river. Interestingly, this stock originated with individuals from Pedroso itself, so we must consider that a strong founder effect took place, which means that the few specimens used to create the stock were not sufficiently representative of the genetic diversity of the natural population. Over the years, genetic drift in this closed stock has accentuated its genetic differentiation from the original population. The fact that we were able to detect hatchery individuals released into the river confirms the genetic differentiation of these individuals and indicates the absence of mixing between them and the recipient population, causing artificial substructure within PE2.

In silico prediction and genetic profiling of somatostatins in gilthead seabream *(Sparus aurata)*

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Abstract content: Somatostatin (SST) and cortistatin (CST) are peptides with high homology in the vertebrate neuroendocrine system, being CST also express in immune cells. However, genome duplication during vertebrate evolution led to the existence of different SST isoforms in teleosts, making it difficult to distinguish them from CST. Therefore, the aim of this study was to identify and characterize the different SST/CST isoforms in gilthead seabream (*Sparus aurata*) specimens and to evaluate their gene expression in naïve organs. Protein sequences of seabream SST/CST obtained from the UniProtKB database were used to construct a phylogenetic tree with the Mega11 software. Sequences were compared by multiple alignment and visualized by Jalview2.11. Constitutive gene expression was analysed by real-time qPCR in different organs: brain, skin, gills, heart, liver, intestine, gonad, head-kidney, spleen, thymus, and blood. The results showed the presence of five SST isoforms in seabream: SST1, SST1A, SST1B, SST2 and SST2-like, although SST2 and SST2-like were encoded by the same gene. Phylogenetic analysis predicted that SST1/1A were most closely related to mammalian SST, and SST1B to CST, whereas SST2/2-like derived from a different evolutionary cluster. Sequence analysis showed that the N-t regions of SST1/1A/2/2-like were highly conserved compared to mammalian and other teleosts. However, SST1B was associated with the CST sequence. Gene expression analysis showed elevated expression of *sst1* and *sst1b* genes in the seabream brain. The *sst1* gene was also highly expressed in the gills, gonad, head-kidney, and thymus. *sst1a* gene was highly expressed in the heart. The rest of the tissues showed limited expression of SST genes. Interestingly, the heart, liver and blood of seabream showed no expression of the *sst2* gene. Our results provide a detailed insight into the phylogeny and gene expression of the different SST/CST isoforms in seabream, which can be used in further studies to elucidate the neuroendocrine and immune mechanisms in fish species of commercial interest.

Fathom Software: Simplifying Data Management

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Abstract content: Fathom is a comprehensive suite of fish tracking tools that provide deep visibility into acoustic telemetry data and make all datasets easy to manage-from collection and curation to analysis and storage. Fathom simplifies how researchers study animals and share their findings, streamlining the crucial work required in the time period between data gathering and publication. The Fathom platform consists of five applications that can be used alone or in conjunction with one another to give full visibility into all aspects of research efforts. Fathom allows researchers to:

– Simplify data collection in the field by using a smartphone or tablet

– Instantly back up detection and environmental data to the cloud while providing real-time access to it

– Mark GPS locations for easy deployments and retrievals, record field data and offload data from underwater receivers using Fathom Mobile

– Track migratory species on the move with Fathom Live and get alerts when a tagged animal is in a designated area

Fathom also lets researchers maintain secure ownership of their valuable data while providing the option to easily share it with their colleagues of choice anywhere in the world. Learn how Fathom software is used to save time, manage animal and deployment metadata and turn detections into ecological insights.

Development of an autonomous multi-parameter framework for water quality and quantity monitoring in real-time based on embedded systems

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Abstract content: Continuous real-time monitoring of various water quality and quantity parameters is essential to improve our understanding of pollution sources and formulating effective strategies to protect aquatic ecosystems. The assessment of water quality parameters in rivers, dams, and lakes as defined in standardized protocols of European Directives, Clean Water Act, and other instruments, typically involves manual collection of water samples in the field at selective periods throughout the year. Water samples are then transported in a controlled environment to a laboratory for analyses. These methodologies require significant logistical effort, costs and may be subjected to potential sample degradation, transcription errors, and temporal delays. Most importantly, they do not provide continuous monitoring, and do not allow the assessment of, for example, episodic pollution events.

This research focuses on the development of a cutting-edge multisensory low-cost prototype to assess physicochemical water parameters. The device can be installed either on a surface platform or along the margin of the water body, enabling the *in-situ* measurement of pH, conductivity, temperature, and water level. The sensors were subjected to calibration procedures to ensure the measurement performance. An embedded system combined with a communication module allows for the collection of data from the sensors and long-range transmission. All components were integrated into a printed circuit board to increase the compactness, portability, and robustness. The setup operates independently in terms of energy, relying on a photovoltaic solar panel. It also integrates a maximum power point tracking module capable of providing charging current, and it relies on a lithium-ion polymer battery for energy storage. The collected data can be sent to a database through GSM/GPRS or WIFI depending on the use case, also a micro-SD card is present for offline data storage. A user-friendly dashboard was implemented to display the results continuously and remotely, enabling real-time decision making. Ongoing findings include the integration of new sensors to measure dissolved oxygen, oxidation-reduction potential, turbidity, and miniaturization of the system.

Assessing MPA connectivity: insights from acoustic telemetry studies on vulnerable species in the Balearic Islands

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Abstract content: Marine Protected Areas (MPAs) are an effective management tools to conserve marine biodiversity and ensure sustainable fishing activities. To be effective, MPAs must be designed according to the biological characteristics and space requirements of the target species. However, this information is generally unknown for most species, partly due to the lack of automatic monitoring systems. In this regard, the 11 Marine Reserves of the Balearic Islands, because of their great diversity, provide a unique framework for studies on their connectivity and effectiveness as an ecological network.

Within the COREMAR project, we are applying recent technological advances in marine species tracking (acoustic telemetry) to study the movement patterns and behaviour of several species vulnerable to fishing. On the one hand, we used a novel high-resolution acoustic telemetry system to reveal the variability in spacial use and the social structure of the pearly razorfish (*Xyrichtys novacula*). On the other hand, thanks to a large-scale tracking initiative (the Balearic Tracking Network) based on the new inter-compatible Open Protocols (OPi/OPs) for acoustic tracking, we studied the degree of connectivity between three MPAs located in the southwest of Mallorca focusing on the movement patterns of highly mobile species (greater amberjack, *Seriola dumerili*, common dentex, *Dentex dentex*, and several ray and stingray species such as *Dasyatis sp.* and *Gymnura altavela*).

Finally, we assessed the initial ecological effects and effectiveness of a recently established reserve by tagging the newly settled juvenile dusky grouper (*Epinephelus marginatus*). In addition to improving our basic knowledge of the biology of the species, our results will be highly applicable in designing future management plans for biodiversity conservation in the Balearic Islands.

The website AFORO. Developments of a computational environment for otolith databases

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Abstract content: Currently, biological collections have started a digitization process that will increase in the coming years, which aims to create integrative approach to scientific research, and provides open access to mass and precise data based on digital developments as GBIF or the European Dissco Network.

The Otolith Collection integrated in the Marine Biological Reference Collections (CBMR) of the Institut de Ciències del Mar-CSIC is an example of how these digital tools can be developed in an open system. Since 2003, with the aim of addressing different issues related to otoliths and the advancement of technologies, AFORO acronym of Anàlisi de FORmes d'Otòlits (Shape analysis of otoliths), a computational environment with a set of tools including dedicated website, has been gradually expanding its functionality. This implies different ways to measuring otoliths to obtain different type of information through a catalogue that contains images of georeferenciated worldwide 8432 specimens corresponding to 2723 species from 274 families of otoliths sagitta in Actinopeterygians fishes. The 2D and 3D otoliths shape description using different methods gives a comparative view between classical methods (biometrics and Fourier) and the Wavelet transform, used in the automatic classification system of AFORO. Furthermore, the automatic classification system has been improved by incorporating geographical filters. In addition, a dynamic table with relationships between otolith and fish length has been added.

To create an interconnected network, AFORO has been established linkages with database systems such as GBIF, and recently, a bidirectional linkage with Osteobase and FishBase. The wide range of information that AFORO provides on the otoliths opens the possibility to approach new studies or to improving the existing ones, as hearing and balance functions, evolution, ecomorphology, life cycles, trophic ecology, palaeontology and archaeology.

Otolith-temperature estimates in Atlantic bluefin tuna (*Thunnus thynnus*) from the Mediterranean Sea: Insights from clumped isotope measurements

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Abstract content: The subpopulation and/or contingent structure of Atlantic bluefin tuna (*Thunnus thynnus*) in the Mediterranean Sea is undefined, leading to uncertainty about the best strategy for an effective assessment and management of this highly exploited stock. This study aimed to reconstruct temperatures experienced by Atlantic bluefin tuna during the early life stages (<3.5 months) using clumped isotope temperature proxy, an innovative geothermometer for carbonates, that does not require prior knowledge of other environmental parameters such as water oxygen composition. We studied otolith chemistry in fish caught from 3 different areas of the Mediterranean Sea and adjacent waters. We found that mean seasonal temperature estimates from clumped isotopes did not differ significantly from satellite derived and otolith oxygen stable isotopic ratios derived temperatures, except for the central Mediterranean Sea, were clumped isotopes derived temperatures were significantly higher than satellite derived temperatures. However, the sensitivity of the clumped isotope thermometer was found to be lower than that based on the oxygen fractionation equation, with high variance observed in the clumped isotopes derived temperature estimates. We also found that clumped isotope derived temperatures were undistinguishable among bluefin tuna captured in the Gibraltar Strait, the central, and eastern Mediterranean Sea. We discuss the main sources of uncertainty in temperature reconstructions using bluefin tuna otoliths.

Use of Computed Tomography (CT) scan in stranded blue sharks (*Prionace glauca*) reveals necropsy-overlooked impalement injuries caused by swordfish (*Xiphias gladius*)

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Abstract content: Recently, analysis of eighteen strandings in eastern Spain has identified fourteen lethal interactions between blue sharks (*Prionace glauca*) and swordfish (*Xiphias gladius*). In these cases, the sharks were impaled in the cephalic region by swordfish rostrum. While some signs of interaction were easily identifiable, others proved elusive despite thorough physical examinations and dissection on necropsy. Computed Tomography (CT) has emerged as a valuable diagnostic tool for identifying and characterizing these distinctive injuries, even revealing healed wounds from previous impalements. The detailed imagery obtained enables the evaluation of tissue damage and wound trajectory, offering a unique insight into each interaction. We show the efficiency of this technique by using a Somatom Volume Access (Siemens) scanner located at the Oceanogràfic veterinary hospital. Parameters for body exploration included a 5 mm slice thickness and interval, with a retro-recon acquisition of 0.5 mm utilizing lung and mediastinal algorithms. Rostra fragments were discovered embedded in soft tissues or cranial cartilage in twelve sharks, four of which have multiple rostra from past impalements. Two other animals exhibited signs of impalement without fragments. Analysis of the cases always shows adult sharks impaled by juvenile swordfish. The high prevalence (77.8%) and similarity of the interactions diminish the likelihood of chance accidents, suggesting intentional offensive or defensive behaviour by the swordfish. These data suggest that agonistic interactions between swordfish and blue sharks may be more common than previously though. Due to challenges in lesion detection, impalement may have been overlooked in the past, highlighting the importance of employing CT scans whenever possible.

Phagocytosis is not only a matter of leucocytes: phagocytosis of erythrocytes in seabream (*Sparus aurata*)

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Abstract content: In the field of vertebrate innate immunity, phagocytosis is a key defence process by which a cell can engulf a particle of different nature (*e.g.* cellular debris, microorganisms, etc.). This process is mainly carried out by leucocytes (macrophages, granulocytes and B lymphocytes), although it has been shown that in fish, other cells known as non-professional phagocytes, such as fibroblasts, skin mucus-secreting cells, thrombocytes and endothelial cells, are also capable of develop phagocytic mechanisms. In this context, although fish erythrocytes have been implicated in immune activities, their role in phagocytosis has received little attention. Therefore, this study aims to clarify whether erythrocytes from gilthead seabream (*Sparus aurata*) are phagocytic.

For this purpose, erythrocytes were isolated from the systemic blood of seabream specimens, incubated for 20, 40, 60, 60, 80, 100 and 120 min with heat-inactivated yeast labelled with fluorescein isothiocyanate, and their phagocytic activities were studied by flow cytometry and electron microscopy. The results showed phagocytic activity after 40 min of incubation. However, no changes in phagocytic capacity were observed. In addition, the flow cytometry results were corroborated by transmission electron microscopy. Erythrocytes showed characteristic invaginations and evaginations (pseudopod emission), and vesicle formation that could be identified with phagosomes and phagolysosomes. Furthermore, field emission scanning electron microscopy revealed evaginations of the cytoplasmic membrane of seabream erythrocytes. These results demonstrate for the first time the phagocytic process developed by seabream erythrocytes, which may be of interest for basic research in hematology and immunology, as well as for possible application in the aquaculture sector.

Tailored for eels, valuable for all: SUDOANG's Atlas and Database

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Abstract content: The European eel (*Anguilla anguilla*) is in a critical situation, classified as critically endangered due to being outside safe biological limits. Despite the enforcement of Regulation EC1100/2007 by the European Commission in 2007, requiring member states to implement Eel Management Plans for recovery, there has been no observable population improvement. Recognizing the urgency of this matter, the SUDOANG project has been proactive in addressing the challenges associated with European eel management. At the forefront of this initiative is the development of the SUDOANG 1.0.4 database, a pioneering effort to create a standardized spatial database covering Southwestern Europe, including France and the Iberian Peninsula. This innovative database aims to improve the assessment of the European eel in the region. Using Geographic Information System (GIS) tools, the SUDOANG 1.0.4 database compiles comprehensive and standardized data on river courses in Southwestern Europe. This includes key information on water surface details and habitat types surrounding each river segment. What makes the SUDOANG 1.0.4 database truly remarkable is its ability to offer a common river network, facilitating the rapid accumulation of information along the rivers and the natural migratory routes to and from the sea. It goes beyond a mere compilation of data, also incorporating details about different habitats, identifying human pressures with a remarkable count of 106,400 obstacles, and providing estimations of eel abundance and biometrics through the Eel Density Analysis (EDA) model for the reference year 2015 at the river reach scale. This robust river network not only supports the ecological assessment of eel habitats but also holds significant potential for research on other migratory species. The SUDOANG project, with its commitment to creating a standardized and comprehensive database, can play a pivotal role in enhancing our understanding of European eel populations, supporting informed decision-making, and contributing to the wider field of migratory species research.

Pilot experiences of intensive control of exotic aquatic fauna in the upwellings of the Ullals de Baltasar (Ebro Delta Natural Park)

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Abstract content: The small wetland of Ullals de Baltasar at the Ebro Delta (Northeastern Iberian Peninsula) is a complex of lagoons and ditches fed by spring waters, that represents a strategic place for the conservation of Iberian fish. Here, several threatened species persist and coexist, such as the stickleback (*Gasterosteus aculeatus*), Valencia toothcarp (*Valencia hispanica*), big-scale sand smelt (*Atherina boyeri*), or South Iberian spined loach (*Cobitis paludica*), among other native species. All these species are currently threatened, and their local populations are clearly declining.

Unfortunately, numerous introduced species are also founded here, such as wels catfish (*Silurus glanis*), oriental weatherloach (*Misgurnus anguillicaudatus*), topmouth gudgeon (*Pseudorasbora parva*), mosquitofish (*Gambusia holbrooki*) or common platy (*Xiphophorus maculatus*). The presence and proliferation of these exotic invasive fish species, as well as other species of aquatic fauna, such as the blue crab (*Callinectes sapidus*), represents the main threat to the conservation of the native fish species of this small wetland.

To face the challenge of managing these exotic species in the ecologically singular Ullals de Baltasar wetland, various pilot experiences have been designed for the intensive control of their populations. To this end, various models of traps and other selective capture gear are being methodically tested: large traps for capturing large fauna as the wels catfish, bottom traps for capturing benthic fish as the oriental weatherloach, surface traps for capture of small fish (for example mosquitofish), or pitfall traps for decapod crustaceans, among other techniques. The first comparative results of these pilot experiences are presented.

Assessment of the enantiotoxic effects of amphetamine (AMP) and 3,4-methylenedioxymethamphetamine (MDPV) on zebrafish (*Danio rerio*) embryo

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Abstract content: The increased use/abuse of psychoactive substances, such as amphetamine-type stimulants, is a global problem. Psychoactive substances (PAS) are partially metabolized in the liver so drug and their metabolites are excreted by urine and consequently into sewage networks ending in wastewater treatment plants. Therefore, they are detected in rivers due to their inefficient removal. Amphetamine-type stimulants comprise amphetamines (e.g., amphetamine (AMP)) and 3,4-methylenedioxymethamphetamine (MDMA)). MDMA and AMP are both chiral so R and S enantiomers can present distinct toxicity effects. Thus, the assessment of the toxic effects of illicit drugs on non-target organisms, such as vertebrates like the zebrafish (*Danio rerio*) model becomes important to study specific biomarker endpoints. This work aimed to evaluate the potential toxic effects of MDMA and AMP, and its enantiotoxicity on embryonic development and behavioural parameters of *D. rerio*. Zebrafish embryos with ≈ 3 hours post fertilization (hpf) were exposed to (0.02, 0.2, 2, 20 and 200 µg/L of (*R,S*)-MDMA and (*R,S*)-AMP and both pure enantiomers for 96 hours. During the exposure period, several parameters of the embryonic development were analysed and at 120 hpf the larvae behaviour was assessed. Data demonstrated enantioselective effects of MDMA, with (*S*)-MDMA showing a higher toxic effect on embryonic development, whereas (*R*)-MDMA affected locomotor and avoidance behaviour. he exposure to (*R,S*)-AMP caused adverse effects in the first hours of development of zebrafish embryos whereas AMP enantiomers resulted in effects on morphometric measurements. At the behavioural level, (*R*)-AMP induced hyperactivity in exposed larvae.

Our results are of concern since some of the effects were observed at environmentally relevant concentrations, which can cause a reduction of larval viability and an increase in the risk of predation. These findings suggest for the first time the occurrence of MDMA and AMP enantiotoxicity in the early life stages of zebrafish showing the importance of these studies for a more accurate risk assessment.

Barbel conservation aquaculture and stocking

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Abstract content: Barbels are the biggest native cyprinids that inhabit the rivers of the Iberian Peninsula, and almost the only native species with a representative presence in large reservoirs that allow spawning migrations to rivers with suitable spawning grounds and nurseries. However, the high fragmentation of rivers, the loss of spawning areas due to the increasing seasonality and the presence of invasive fish species, are causing the decline of their populations, and even their disappearance in some river sections. In Extremadura, four species of barbel are present, the short-headed barbel (*Luciobarbus microcephalus*), the comizo barbel (*Luciobarbus comizo*), the common barbel (*Luciobarbus bocagei*) and the southern barbel (*Luciobarbus sclateri*), with 3 species in the Guadiana basin and 2 in the Tagus basin.

Aquaculture centers managed by Fisheries and Aquaculture Area of Extremadura Regional Government, are mainly dedicated to the reproduction of native fish for conservation stocking purposes. Captive reproduction of barbel is being carried combining different reproduction techniques: (1) Capture of breeders in spawning areas and in-vitro reproduction (2) natural reproduction in ponds (still with very poor results), and (3) hormonal induction (poorly used).

From April to June, during the reproduction period of the species, breeders are captured by electric fishing in selected spawning areas, checked for manual extraction of gametes for in-vitro fertilization of eggs in the field. Fertilized eggs are transferred to hatcheries in the aquaculture centers, and fries are reared in outdoor ponds, with natural temperature and photoperiod, with vegetation, shelter and occasional presence of predators, where they are kept for a minimum of 6 months before being stoked.

Survival in hatcheries varies between 30% and 60% and between 40% and 65% in nursery-ponds. Total number of fingerlings stoked annually is around 10,000 specimens of common barbel, 8,000 of short-headed barbel and 15,000 of comizo barbel.

The long distances traveled to capture broodstock in the breeding areas, the high climatic variability and the reduction in the number of broodstocks, combined with the need of large pond surface area make it difficult to produce a high number of fingerlings.

NexTrak: The Future of Acoustic Telemetry

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Abstract content: NexTrak, Innovasea's breakthrough acoustic telemetry system, is ushering in a new era of science, collaboration, and discovery for aquatic animal researchers. It delivers improved performance and higher quality data, enabling scientists to explore new habitats. The R1 receiver is the first product available as part of a larger NexTrak ecosystem of new receivers, transmitters, and enhanced cloud-based tools that will provide researchers with a richer, more complete picture of animal behaviour. Recent R1 field tests show 40 percent greater range than previous receivers which reduces the number of receivers required to cover the same area. Its advanced processor is better at filtering out noise and decoding tag transmissions leading to twice as many detections while also allowing researchers to reliably track fish in challenging acoustic environments. NexTrak technology also provides:

– Less interference and fewer tag collisions

– Signal strength data to better show the proximity of fish to deployed receivers

– Higher quality data and enhanced post-processing capabilities

NexTrak makes aquatic animal tracking easier by making deployments, maintenance and data retrieval more efficient. In addition, the range improvement and better coverage mean less equipment to purchase up front, lowering the total cost of ownership and making acoustic telemetry more accessible.

Detection of silent invasions using genetic diagnostic tools: new distribution data of invasive cryptic species of freshwater fish in Catalonia

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Abstract content: One essential component in the understanding and control of bioinvasions is the accurate taxonomic classification of the invasive species. Thus, species that remain undetected or are incorrectly identified can introduce complexities into our understanding of bioinvasions. The scarcity of reliable morphological characters for certain cyprinid species can lead to misrecognition, potentially contributing to the delayed detection of invasive species. This scenario increases the likelihood of a 'hidden' invasion, i.e. an invasion that remains undetected until the invasive species has both established and dispersed, thereby achieving a relatively extensive distribution prior to detection. The genetic technique of DNA barcoding is widely used for freshwater fish's species identification using a short mitochondrial DNA sequence of cytochrome c oxidase I (*COI*) gene. DNA barcoding is an accurate tool for species identification, authentication, and phylogenetic analysis which can enable to detect bioinvasions in early stages. Fish samples were amplificated and sequenced from three potential genera (*Carassius*, *Blicca* and *Abramis*) in five rivers of Catalonia (Muga, Segre, Ebro, Ter and Francolí).

The goldfish *Carassius auratus* is known to be widedspread in Catalonia, but the presence of the morphologically similar Prussian carp *Carassius gibelio* had not been reported to date. In this work, the presence of *C. gibelio* was detected in the Francolí and Ter basins, while the presence of *C. auratus* was confirmed in the Ebro basin. The white bream *Blicca bjoerkna* and the common bream *Abramis brama* also are two species with high morphological resemblance, and they were introduced in Catalonia around the 2000s. Its known distribution to date were the Ebro basin for *B. bjoerkna* and the Muga basin for *A. brama*, which was confirmed by molecular methods. However, the identification of one individual of *B. bjoerkna* in the Muga basin reveals that this species is now present and may be expanding in this area, which had gone unnoticed.

Ongoing data collection of marine recreational fisheries in Catalan coastal waters (NW Mediterranean Sea)

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Abstract content: Marine recreational fishing (MRF) is currently one of the most popular coastal leisure activities worldwide, yet there exists a significant gap in our understanding of its impact and management strategies. In 2017, the Catalan Institute of Research for the Governance of the Sea (ICATMAR) was created in Catalonia, where the main aim is to offer scientific advice on both commercial and recreational fishing to regional, national and European policy makers. The data collection started in 2019 with a trial sampling that set the baseline of the annual continuous monitoring of MRF along the Catalan coast. The objective of this communication is to describe the methodology of this monitoring, which is based on a combination of on-site and online surveys. A total of 4,600 surveys are sent online monthly, obtaining an average response ratio of 25%, and an annual average of 10,000 responses. For the on-site surveys, 105 sampling trips (which accounts for an average of 1,300 fisher surveys per year) were carried out along the Catalan coast, ensuring the coverage of all seasons both during working days (40% of all trips) and weekends or holidays (60% of all trips). Preliminary results from 2022 show that most of the community are shore anglers (52%), followed by boat anglers (36%) and spearfishers (12%) which fish on a variety of species, according to location and season. The most broadly fished species are from sparids family and the season with the highest catches is summer, due to the increase of the tourism at this time of the year.

Sightings and appearances of sharks along the Catalan coast (NW Mediterranean) reported in the media from 1992 to 2023

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Abstract content: The Catalan Association for the Responsible Fishing (ACPR) was created in Catalonia in 1999. It is a non-profit organisation that acts in defence of the interests of the recreational maritime surface fishing (RMP). With the aim of promoting values and transmitting knowledge and interest in RMP, the ACPR carries out various tasks on issues related to recreational fishing resources, in collaboration with scientific, environmental education and training entities. In this working, we have produced a compilation of publications related with shark sightings (more than 100), in the media, both traditional and electronic press, TV and other media, from 1992 to 2023. Specifically, we have collected sightings of dead sharks on beaches, visual sightings by citizens and daily reported catches by commercial fisheries (only artisanal fisheries, not longliners) each time they were published in the media, with the aim of keeping a systematic record. Information on commercial catches by longliners is excluded from this collection because the locations of catches are uncertain. We identified up to nine shark species: *Prionace glauca*, *Isurus oxyrinchus*, *Carcharhinus plumbeus*, *Alopias vulpinus*, *Cetorhinus maximus*, *Somniosus rostratus*, *Carcharodon carcharias*, Hexanchus griseus, *Heptranchias perloin*, in addition to other sharks not identified to species level. Our final goal is to detect the areas where sharks are present and to know which species occupy each area. Our work has been successful in detecting deep-sea sharks near submarine cannons and in defining two areas on the south coast of Catalonia, where pelagic sharks have more density. Compiled data represents a good knowledge to establish the basis for a future investigation on shark distribution. For instance, our association have collaborated in the tagging of sharks with different scientific institutions (CSIC, Barcelona University) and the data provided represents a valuable tool to identify the most likely areas for tagging sharks.

Morphometry and microchemistry of otoliths as a tool to distinguish two species of the same genus (*Mugil liza* and *Mugil curema*) and to differentiate the estuarine systems where they inhabit

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Abstract content: The importance of the estuarine and coastal ecosystems highlights them as relevant natural environments, which play a crucial role as nurseries for several fish species, including the Mugilidae family, which use these areas throughout their life cycle. Differentiation between species in the juvenile stage is challenging due to the external morphological similarities and to the overlapping meristic counts. The main objectives of this study were to evaluate the use of the sagittal otoliths to distinguish the juvenile species of *Mugil liza* and *Mugil curema* using morphometric and microchemical techniques, and to compare the minor and trace elements composition in otoliths to differentiate the estuarine systems where the individuals inhabit. Shape and otolith contour analyses were carried out on 230 otoliths, and elemental chemical analyses were carried out on 10 fish otoliths from each of the two lagoons and two adjacent coastal bays studied. According to morphometry, two major groups were found that appear to be directly related to the differentiation of the two species, but with some overlaps. Chemical analyses revealed about 55 chemical elements in the Mugil otoliths, in different concentrations at each location. The chemical concentrations indicated an efficient separation of fish between the studied sites with a 100% reclassification from the linear discriminant analysis. The methodology was effective in separating the individuals per sites, but the shape analyses was not as efficient for separating the species. Otolith shape studies are more suitable for the identification of adult fish as the growth rate of juveniles can influence the sagittae morphology during the first years of life.

Design and installation of a gravel filter to prevent the penetration of fish and other exotic fauna in a Red Natura 2000 pond, located on the banks of the Ter River (Girona)

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Abstract content: The GiroNat project, founded by the European Next Generation funds through the Fundación Biodiversidad (MITECO), aims to transform the city of Girona through renaturalization, making it a greener, more resilient, and healthier city. One of the objectives of this project is the ecological restoration of urban and peri-urban lagoons and ponds. Among the various strategies for this restoration, several actions have been designed to eliminate nuclei of exotic aquatic species that have colonized some of these water bodies, compromising their ecological state and preventing the establishment of native species of interest. These are, above all, fish such as goldfish (*Carassius auratus*) or carp (*Cyprinus carpio*), often accompanied by other exotic aquatic species such as the Florida terrapin (*Trachemys scripta*) or the Louisiana crayfish (*Procambarus clarkii*), all of which are recognized as invasive due to their direct impact on native species, habitats, and ecological processes.

In the case of the lagoons of the Santa Eugènia orchards, located on the banks of the river Ter, the list of exotic fish present is considerably expanded: largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), roach (*Rutilus rutilus*), among others. This is because its hydrological operation involves a constant inflow of water from the network of irrigation ditches in the area, which in turn are fed by a large ditch that take part of the flow from the Ter River itself, where all these exotic species are present. In this case, simply removing the stock of exotic fish from these lagoons would not be enough to solve the problem, since new colonization would immediately occur through the hydrological network to which they are connected. For this reason, in the largest pond (0.23ha), a gravel filter has been installed in the only water inlet channel, to prevent the entry, again, of exotic species of aquatic macrofauna (>15mm). The technical details of this action will be presented, as well as pictures of the gravel filter.

Deciphering the serum proteinogram profile of gilthead seabream (*Sparus aurata*)

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Abstract content: A proteinogram is a semiquantitative method of analysis that allows the separation of proteins by electrophoresis into different bands. This methodology has been widely used in clinical practice to detect the presence of abnormal or excess of proteins in serum, or other body fluids, which can be indicative of liver, inflammatory and immune disorders. Specifically, electropherograms have recently emerged as a specialization of protein electrophoresis in which the fluorescence intensities of proteins are measured as a function of their migration times. This method, which is widely used in humans, has not been studied in fish for diagnostic purposes. In this study, ten specimens of gilthead seabream were anesthetized, and blood samples were collected. Proteins were quantified with the Direct Detect Spectrometer (Merck-Millipore) and adjusted to 1,500 ng μL^{-1} in PBS. Serum proteins were then separated by SDS-PAGE and using a bioanalyzer (with Agilent Protein80 and Protein230 kits) from which electropherograms were obtained. Finally, proteins from the diluted serum samples were identified by HPLC-mass spectrometry.

The results of the SDS-PAGE analysis showed four main protein bands around 11, 25, 70 and 100 kDa in the serum of the seabream specimens, and several undefined protein bands. Similarly, the electropherograms also showed four major peaks of proteins with the same molecular weight, representing, respectively, 16.1% of the total serum proteins in protein80 kit, and 17.8%, 27.6% and 20.3% in protein230 kit. The rest of minor proteins made up the remaining percentage. The results obtained with HPLC-mass spectrometry showed 87 proteins in the serum of seabream. Matching the molecular weight of the proteins found by HPLC-mass spectrometry and by electropherograms, the four proteins in high concentration were identified as apolipoprotein C-I, an uncharacterized protein, serotransferrin and Inter-alpha-trypsin inhibitor heavy chain H3-like, respectively. These results help to establish the normal reference values for the serum proteinogram of seabream and provide a basis for addressing new approaches to disease diagnosis in farmed fish.

Assessing the current distribution of the invasive European catfish in Portugal: from people to molecules

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Abstract content: The European catfish (*Silurus glanis* L., 1758) has recently invaded the Portuguese freshwaters, occurring mainly in the Tagus and Douro main streams. However, given its interest for recreational fisheries, the current distribution of the European catfish is changing dramatically across the Portuguese watersheds. Here, we will present different methodological approaches to update the species current distribution and put forward potential invasion routes between different water bodies in Portugal. First, data involved data mining from online records with associated location, date and images. These records were obtained from Social Media networks (e.g. anglers Facebook groups; YouTube channels) or regional news media channels (e.g. Médio Tejo News). Secondly, we interviewed professional fishermen and anglers to obtain additional catfish records. This occurrence data was complemented with records from scientific fishing sampling done mainly in the Tagus drainage, using gill nets, electrofishing and longlines. In 2024, we will sample water from 25 reservoirs across three different drainages (Douro, Tagus and Guadiana) in Portugal, in order to obtain new records based on environmental DNA. We will use a high-resolution (q-PCR) technique that will be very sensitive in the catfish detection event in low abundances. The updated distribution obtained will be essential to determine future areas of high risk of invasion and implement management actions to stop the spread of this invader in Portugal.

SIBIC 2024
X Iberian Congress of Ichthyology

ISBN: 978-84-128959-0-2

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