

LIFE INVASAQUA

AQUATIC INVASIVE ALIEN SPECIES OF FRESHWATER AND ESTUARINE SYSTEMS: AWARENESS AND PREVENTION IN THE IBERIAN PENINSULA

Actions, Key-Instruments & Lessons Learned





LIFE **INVASA**QUA



LIFE INVASAQUA and surveys

Raise general public awareness about the threats caused by aquatic Invasive Alien Species (IAS).

Knowledge

Risk actions

Intentional introductions

Accidental introductions

www.lifemasqua.com

fin

MÁLAGA

INFORMACIÓN

LIFE INVASAQUA

El primer sistema europeo de agua dulce y acuicultura para la gestión, control y prevención de las Especies Exóticas Invasoras.

www.lifemasqua.com

fin

International networking events “Exchanging Experiences on IAS Projects in Europe: Lessons Learned” (Málaga, May 2023).

LIFE INVASAQUA
AQUATIC INVASIVE
ALIEN SPECIES OF
FRESHWATER AND
ESTUARINE SYSTEMS:
AWARENESS AND
PREVENTION IN THE
IBERIAN PENINSULA.

**Actions, Key-Instruments &
Lessons Learned**

Authors

Oliva-Paterna F.J., Olivo del Amo R., López Cañizares C., Guillén Beltrán A., Torralva M.,
Anastácio P.M., Banha F., Brandão P., Miranda R., J. Oscoz, Cobo F., Barca S., Casals F.,
Ribeiro F., Perdices A., Clavero-Sousa H., C. Numa.

LIFE INVASAQUA – TECHNICAL REPORT



International networking events “Exchanging Experiences on IAS Projects in Europe: Lessons Learned” (Málaga, May 2023).

LIFE INVASAQUA - Aquatic Invasive Alien Species of Freshwater and Estuarine Systems: Awareness and Prevention in the Iberian Peninsula

LIFE17 GIE/ES/000515

This publication is a Technical Report of the European Project **LIFE INVASAQUA** (LIFE17 GIE/ES/000515). The outputs expressed do not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication. The photographs and pictures illustrating this report belong to the **LIFE INVASAQUA** Team unless otherwise indicated.

All the information generated by the **LIFE INVASAQUA** Project is freely available on its web platforms (<http://www.lifeinvasaqua.com/>; <https://eei.sibic.org/>; <https://ibermis.org/>).

Published by LIFE INVASAQUA ©

ISBN: 978-84-127861-3-2

D.L.: MU 55-2024

Date of completion: 31/10/2023

Design: BIOVisual S.L.

This technical report shall be cited as:

Oliva-Paterna F.J., Olivo del Amo R., López Cañizares C., Guillén Beltrán A., Torralva M., Anastácio P.M., Banha F., Brandão P., Miranda R., J. Oscoz, Cobo F., Barca S., Casals F., Ribeiro F., Perdices A., Clavero-Sousa H., C. Numa. 2024. **LIFE INVASAQUA - AQUATIC INVASIVE ALIEN SPECIES OF FRESHWATER AND ESTUARINE SYSTEMS: AWARENESS AND PREVENTION IN THE IBERIAN PENINSULA**. Actions, Key-Instruments & Lessons Learned. *Technical Report prepared by LIFE INVASAQUA (LIFE17 GIE/ES/000515)*.

Abstract

The Spanish and Portuguese societies have a limited understanding of the threats posed by invasive alien species (IAS) in aquatic ecosystems. This gap of knowledge and awareness about IAS problems hampers any policy proposed by administrations and stakeholders, contributing to missing an IAS management strategy. We present the actions, main results and some learned lessons achieved in the Environmental Governance and Information LIFE project—**LIFE INVASAQUA**—that will run between 2018 and 2023 in the Iberian Peninsula. The main goal of INVASAQUA was to increase the Iberian public and stakeholders' awareness of aquatic IAS problems and to develop instruments and tools that will improve an efficient management and Early Warning and Rapid Response frameworks for IAS in freshwater and estuarine ecosystems. This Technical Report focus on tangible results, key-instruments and outcomes of the project to explore some of the problems and lessons encountered in the implementation.



Table of Contents

Authors and contributors	9
Acknowledgements	10
Technical sheet of the Project	11
Part 1. THE NEED FOR THE LIFE INVASAQUA PROJECT	13
1.1. Invasive alien species: a priority for the EU biodiversity policy	14
BOX 1: The Problem – By Numbers	
1.2. A key problem in Inland Waters – LIFE INVASAQUA looked for solutions	15
1.3. The LIFE INVASAQUA Project: Aim and Objectives	16
BOX 2: Public and private stakeholders involved by LIFE INVASAQUA	
Part 2. PROJECT ACTIONS AND KEY INSTRUMENTS	19
2.1. Governance and Research	20
2.2. Dissemination and Training to target groups	26
2.3. Communication and Awareness	29
2.4. Transferability and Replicability	34
Part 3. OUTCOMES AND LESSONS LEARNED	37
3.1. Tangible Results and Lessons Learned	38
BOX 3: Project Impact – By Numbers	
3.2. Long-term Outcomes	39
References	40
List of Authors affiliations	44
ANNEX – Tangible Results & Lessons Learned by LIFE INVASAQUA Actions	46

Authors and contributors

Authors of the Technical Report

Oliva-Paterna F.J., Olivo del Amo R., López Cañizares C., Guillén Beltrán A., Torralva M., Anastácio P.M., Banha F., Brandão P., Miranda R., J. Oscoz, Cobo F., Barca S., Casals F., Ribeiro F., Perdices A., Clavero-Sousa H., C. Numa.

Coordinating team of the LIFE INVASAQUA Project

Oliva-Paterna F.J. (Coord.), Olivo del Amo R., López Cañizares C., S. Garrido García.

Staff of the Project (Order by affiliations)

University of Murcia (Spain)

Oliva-Paterna F.J., Olivo del Amo R., López Cañizares C., Garrido García S., Guillén Beltrán A., Torralva M., Zamora-Marín J.M., Oficialdegui F.J., Herrero-Reyes A.A., Ruiz-Navarro A., Ubero Pascal N., Esteban M.A., Guardiola F.J., Calvo J.F., P. Sánchez.

University of Evora – MARE (Portugal)

Anastácio P.M., Banha F., Diniz A., P. Brandão.

University of Navarra (Spain)

Miranda R., J. Oscoz.

University of Santiago de Compostela (Spain)

Cobo F., Barca S., R. Vieira.

Iberian Society of Ichthyology (SIBIC) (Spain and Portugal)

Casals F., Ribeiro F., J.R. Sánchez González.

IUCN-Mediterranean Cooperation Center (Spain)

Numa C., Lázaro L., Clavero-Sousa H., A. Alcántara.

National Museum of Natural Sciences – CSIC (Spain)

Perdices A., Machordom A., Lambistos I., B. Martínez Olmedo.

Portuguese Association for Environmental Education – ASPEA (Portugal)

Diniz J., Pinto J., Correia M.J., L. González Munuera.

EFE - Agency (Spain)

Arturo Larena A., Yuste C., Tuñas A., J.L. Fernández-Checa.

Main external collaborators – Experts of the INVASAQUA committee (Alphabetical order)

Arias A., Boix D., Capdevilla-Argüelles L., Clavero M., Cuesta J.A., Fernández-Delgado C., Gallardo B., García-Berthou E., García-Murillo P., Gómez-Calmaestra R., Guerreiro P.M., Magalhães M.F., Morcillo F. and Q. Pou-Rovira.

Acknowledgements

This report was financially supported by the **LIFE INVASAQUA** project (Aquatic Invasive Alien Species of Freshwater and Estuarine Systems: Awareness and Prevention in the Iberian Peninsula) (LIFE17 GIE/ES/000515) funded by the EU LIFE Program.

We would like to thank all Member States competent authorities, Societies, NGOs, scientists and managers which have contributed to the scope of the **LIFE INVASAQUA** Project, for their active collaboration and the supply of logistics and information. We are particularly indebted to the Fundación Biodiversidad (Government of Spain) and the Government of Navarre for their economic and logistical support for the SIBIC actions into the **LIFE INVASAQUA** Project.

The Project team would also like to gratefully acknowledge the experts and managers of Public Administrations from Spain and Portugal who contributed to the participatory methodologies developed by **LIFE INVASAQUA**, particularly by participation in several events during the process and through the personal communications and discussion, with useful information, comments and insights. Among agencies from Administrations, especial thanks to: Dirección General de Biodiversidad, Bosques y Desertificación (MITERD, Spain), Instituto para a Conservação da Natureza e das Florestas (ICNF, Portugal), Dirección General del Agua, Grupo de trabajo de Organismos de cuenca sobre EEI (MITERD, Spain), Agência Portuguesa do Ambiente (APA, Portugal) and Conselho Nacional da Água (CNA, Portugal).

Special thanks go to the main external experts for their selfless collaboration and expert input that has consolidated work processes and the scientific-technical information generated.

We would like to thank the rest of Authorithies or Agencies, Societies, NGOs, scientists, and other stakeholders which have also contributed to the scope, for their active collaboration and cooperation, many of these institutions involved in actions of the Project.

Technical sheet of the Project

TITLE	Freshwater and Estuarine Invasive Alien Species: Awareness and Prevention in the Iberian Peninsula
ABBREVIATION	LIFE INVASAQUA
REFERENCE	LIFE17 GIE/ES/000515
COORDINATING BENEFICIARY	University of Murcia; Francisco J. Oliva Paterna (Coordinator) fjoliva@um.es
ASSOCIATED BENEFICIARIES	Agencia EFE, IUCN—Centre for Mediterranean Cooperation, Spanish National Research Council's National Museum of Natural Sciences (MNCN-CSIC), Iberian Society of Ichthyology (SIBIC), University of Navarra, University of Santiago de Compostela, University of Évora and Portuguese Association for Environmental Education (ASPEA)
CO-FINANCING	Biodiversity Foundation and Government of Navarra
TOTAL BUDGET	3,075,039 €; EU contribution: 1,844,656 €
DURATION	5 years (01/11/2018 - 31/10/2023)
WEB	<u>Official web site:</u> (http://www.lifeinvasaqua.com/) <u>Invasive Alien Species web platform:</u> (https://eei.sibic.org/) <u>IBERMIS platform:</u> (https://ibermis.org/)

Coordination:



Associated Beneficiaries:



With the support of:





Awareness event of the LIFE INVASAQUA (ASPEA) in the World Rivers Day, 2022.



1

The need for the LIFE INVASAQUA project

Invasive Alien Species (IAS) are animals and plants that are introduced accidentally or deliberately into a natural environment where they are not normally found, with serious negative consequences for their new environment. They represent a major threat to native plants and animals in Europe, causing damage worth billions of Euros to the European economy every year. As invasive alien species do not respect borders, coordinated action at the European level will be more effective than individual actions at the MS level.

European Commission website (December 2022)

1.1. Invasive alien species: a priority for the EU biodiversity policy

Biological invasions are one of the major drivers of global change that threatens biodiversity, ecosystem services, and human health (IPBES 2023). Increasing rates of species introductions (Seebens et al. 2017), climate change (Gallardo et al. 2018) and other anthropogenic influences, such as globalisation as well as human-altered habitats, favour the establishment and spread of alien species (Hulme 2021).

According to the European Commission, Invasive Alien Species (IAS) are defined as species, subspecies or lower taxa whose introduction and spread outside their natural ecological range have been found to threaten or adversely impact to biodiversity and relative ecosystem services (EU Regulation 1143/2014). The introduction of IAS can alter ecosystems and are one of the main anthropogenic global drivers of species extinctions, incurring high economic costs (Diagne et al. 2021). Although alien species have been entering Europe for centuries, their numbers have risen exponentially over the last 50 years, principally as a result of increased trade and travel, and the established IAS are unlikely to decrease in the near future. For instance, it is estimated that by 2050 established IAS in Europe will have increased by around 64% (Seebens et al. 2021).

The current spread of IAS around Europe creates complex challenges that threaten both its biodiversity and the well-being of its citizens. Although this problem is on continental level, the nature and severity of the impacts on natural heritage, society and the economy are unevenly distributed across Member State (MS) and biogeographic regions (Oficialdegui et al. 2023). In fact, some aspects of the problem require solutions tailored to the specific values, needs and priorities of each MS, while others require consolidated EU action. Preventing international movements of IAS and coordinating an effective response to invasions will require cooperation and collaboration among governments, economic sectors, NGOs and other organisations (IPBES 2023).

The *European Strategy on Invasive Alien Species* developed under the Bern Convention (Genovesi & Shine 2011), already highlighted the need for implementing coordinated measures among European states, to prevent or minimise the adverse effects of IAS. Recognising this need, the European Parliament and Council adopted the Regulation (EU) No 1143/2014 (hereafter referred to as the IAS EU Regulation). This regulation on invasive species sets out rules to effectively tackle the problems linked to IAS, seeking to prevent their entry into the MS, to set up a system of early warning and rapid response, to ensure a prompt eradication of localised IAS and to more efficiently manage the IAS that are established and spread within the EU territory (Genovesi et al. 2015, Reaser et al. 2020).

BOX 1.**The problem – By the Numbers**

- More than 37, 000 alien species established worldwide, more than 14, 300 are occurred in Europe. Of these, more than 3,500 IAS have documented impacts that play a key role in 60% of global plant and animal extinctions.
- 80% of IAS impacts on nature’s services to people are negative.
- Global cost on IAS damage exceeded \$423 billion in 2019, and it has quadrupled every decade since 1970.
- Finally, 85% of documented impacts negatively affect quality of life, for example through effects on human health.

Quantitative information obtained from the *Summary for Policymakers of the Thematic Assessment Report on Invasive Alien Species and their Control of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (IPBES 2023) and from the *European Alien Species Information Network* (EASIN 2023).

1.2. A key problem in Inland waters – LIFE INVASAQUA looked for solutions

Due to their connection to humans and their activities, inland waters (i.e. freshwater and transitional waters) are particularly vulnerable to either inadvertent or deliberate IAS introductions (Flood et al. 2020, Mc). In addition, compared to terrestrial and marine ecosystems, inland waters are especially threatened by biological invasions due to their intrinsic environmental features (McFadden et al. 2023). As a consequence, there is a growing evidence of major impacts caused by IAS at multiple ecological levels in inland waters, with well-demonstrated detrimental effects on native aquatic biota, ecosystem functions and services (Gallardo et al. 2016, Guareschi et al. 2021). Economic costs of aquatic invasions are equally significant, with both damage and management costs estimated to be at least \$23 billion per year (Cuthbert et al. 2021). In Spain, for example, considering only robust data (i.e. excluding extrapolated, potential and low reliability costs), economic costs of IAS were estimated at € 232 million from 1997 to 2022 (Angulo et al. 2021), and ca. €50 million have been spent on control actions for water hyacinth in the Guadiana basin between 2004 and 2020 (MITERD, Spain).

Similarly, to the increasing trend in alien species introductions across all environments, the number of aquatic IAS is also increasing rapidly as well as their rate of spread, especially in European inland waters (Nunes et al., 2015). In a study coordinated by **LIFE INVASAQUA**, 326 aquatic IAS have been inventoried in Iberian inland waters, mostly introduced over the second half of the 20th century and a high number of IAS introductions being reported in the 2000s (Zamora-Marín et al. 2023). By combining scientific knowledge on taxa with expert opinion, experts of **LIFE INVASAQUA** also identified the most relevant aquatic IAS in the Iberian Peninsula that were considered as a management priority (Oficialdegui et al. 2023a).

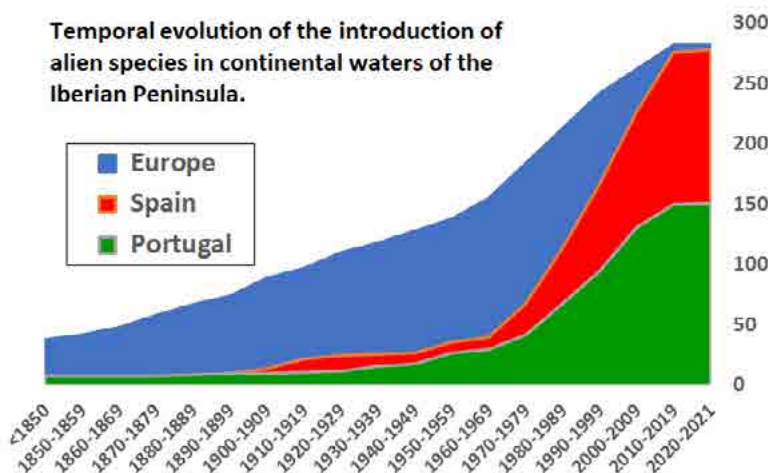


FIGURE 1. Trends of the introduction of IAS in inland waters of the Spain and Portugal (and the same taxa in Europe). Modified from a study coordinated by the **LIFE INVASAQUA** Project: *A multi-taxa assessment of aquatic non-indigenous species introduced into Iberian freshwater and transitional waters* (Zamora-Marín et al. 2023).

Because IAS are a global threat, unilateral action by each country is not enough to prevent new introductions and to mitigate their impacts. Cooperation at international, regional and trans-boundary levels is essential to develop compatible approaches (Faulkner et al. 2020). The management of IAS is therefore a complex and transnational challenge that requires multi-faceted actions involving diverse institutions and stakeholders at different spatial scales (Baquero et al. 2021). Transnational communication, cooperation and collaboration are essential to ensure successful implementation of aquatic IAS management strategies (Caffrey et al. 2014), especially when river basins or water transfer systems are shared among countries. Thus, the need for regional approaches at biogeographical levels (e.g. Iberian Peninsula) has long been recognised by EU institutions. In fact, the Article 11 of the IAS EU Regulation states that coordination and cooperation among MS is pivotal to address a strategic management.

Under the IAS EU Regulation, Spain and Portugal must prevent the entry of alien species, contain their spread within their territories, implement effective Early Warning and Rapid Response (EWRR) mechanisms to detect new introductions and adopt management measures for IAS that are already established. The IAS EU Regulation has been transposed into Spanish and Portuguese legislations and is implemented by each national administration, with the Spanish IAS catalogue (related to R.D. 630/2013 in Spain) and the Portuguese National List of IAS (related to R.D. 570/2020 in Portugal) being pivots in this Regulation. However, collaboration and partnership between administrative agencies, NGOs and other stakeholders in both MS should be encouraged and enhanced to achieve the objectives of the IAS EU Regulation (Oficialdegui et al. 2023a, Zamora-Marín et al. 2023).

Spain and Portugal face similar constraints in their IAS management efforts (Oliva-Paterna et al. 2022, 2023a). These may include:

- Low public awareness and opposition to government intervention.
- Poor coordination between administrative agencies and other stakeholders.
- Absence of common and agreed priorities for action.
- Non-harmonized legal frameworks.
- Inadequate monitoring capacity.
- Lack of effective rapid response measures.
- Shortage and inaccessibility of scientific and technical information.
- Lack of funding to manage the increasing number of established and upcoming IAS.

General public, decision-makers and other stakeholders have limited understanding about the threats posed by IAS occurring in aquatic ecosystems. These gap of knowledge and lack of awareness hampers any management policy proposed by public administrations and other stakeholders, particularly for IAS that do not affect human health or major economic interests. IAS and their impacts are either not known at all or frequently considered without socio-economic effect (Banha et al. 2022). Furthermore, its control and management is frequently considered as hindering potential economic development (Banha et al. 2017). Lack of awareness by the public and by the main stakeholders contributes to a missing IAS management strategy in Iberia Peninsula aquatic environments. Raising awareness and commitment is also essential to develop shared responsibility and to encourage private efforts and voluntary compliance.

Although Spain and Portugal have made progress in implementing policies to reduce the impact of IAS, the involvement of all stakeholders, governments and the private sector must increase to optimise their management. To this end, raising awareness in society is essential and LIFE INVASAQUA has generated knowledge transfer and increased social perception of the problem.

1.3. The LIFE INVASAQUA Project: Aim and Objectives

The **LIFE INVASAQUA** Project is a European Environmental Governance and Information project with the purpose to improve information, training, and awareness of the problems created by IAS in Iberian aquatic ecosystems. In its scope, the Project has intended to be useful to improve the transnational response capacity to deal with IAS by promoting collaboration with decision-makers and stakeholders

and ensure information sharing and exchange.

The specific objectives of the **LIFE INVASAQUA** Project have been:

- Support and enable the implementation of the EU IAS Regulation by creating synergies between knowledge creation and managers.
- Increase and improve the capacity of Spain and Portugal for early warning and rapid response in IAS management (EWRR) through raising awareness and the training of key groups (environmental agents, river and estuary users, educators and knowledge multipliers, etc.).
- Raise awareness among the general public about the threats caused by aquatic IAS through a mass communication campaign.

Therefore, In the framework of the **LIFE INVASAQUA** project, multiple actions related to governance and research, training, communication, transferability and replicability have been developed in Spain and Portugal, targeting both the main stakeholders (key groups) and the general public, in order to increase the capacity to manage IAS. This technical report is a summary of the project actions, key instruments and lessons learned mainly addressed to nature conservation administrative agencies and other sectorial agencies with responsibility on IAS issues. The document also seeks to engage the general public and stakeholders involved in the introduction, translocation, use and management of aquatic IAS and to build on the expertise and commitment of non-governmental organisations and research institutions.

BOX 2.

Public and private stakeholders involved by LIFE INVASAQUA

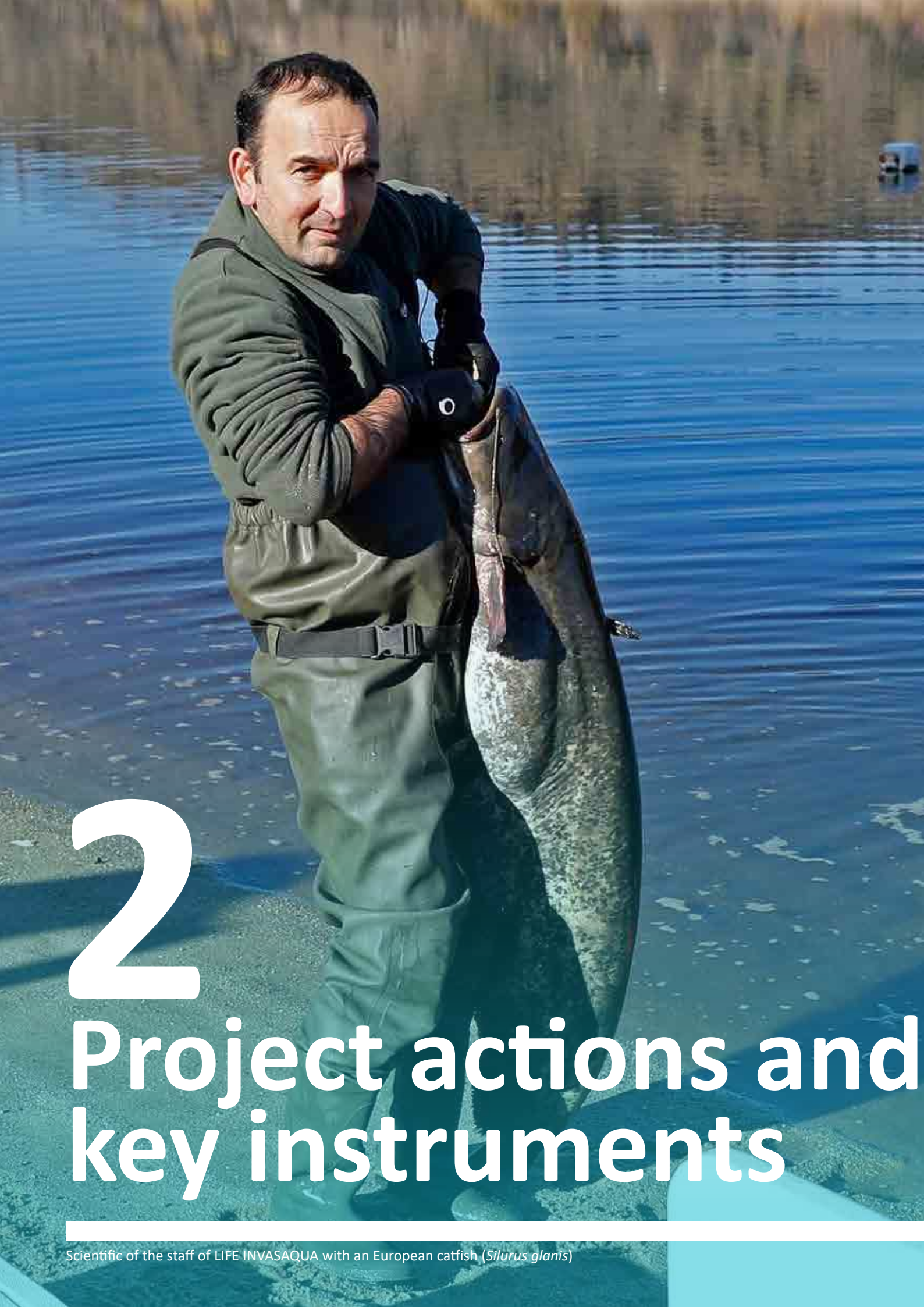
Stakeholders are individuals, groups and organizations that are actively involved in the IAS issues or whose interests may be affected by the IAS management. The involvement of stakeholders is critical for ensuring the management success and for the synthesis of evidence on what works, where, and for whom, providing key benefits.

The main public and private stakeholders involved by LIFE INVASAQUA are:

- Public Administration: wildlife managers, protected area managers, wildlife trade personnel, water resource managers, and other government departments (national and regional) responsible for agriculture and forestry.
- Scientific Community (Universities and Research Centres).
- Environmental NGOs and Consultancies.
- Surveillance Agents, customs and quarantine services (e.g. Fluvial and Environmental agents, etc.).
- River and Estuary users: Associations for irrigation agriculture, aquaculture, recreational fishing, commercial fishing, water sports, etc.
- Knowledge multipliers: Environmental educators, museums, botanic gardens, zoological parks and aquariums.
- Education sector: students and teachers of Universities, Primary and Secondary Education, etc.
- Business and Commercial: pet and animal retailers, ornamental fish and aquarium trade, tourism/travel, aquaculture, etc.
- Media: Agencies and journalists.
- Citizen or general public.



VI National Congress and I Iberian Congress on Invasive Alien Species (EEI 2022) (Pamplona, April 2022).



2

Project actions and key instruments

Scientific of the staff of LIFE INVASAQUA with an European catfish (*Silurus glanis*)

The **LIFE INVASAQUA** Project has been implemented multiple actions related to governance and research, training, communication, transferability and replicability in Spain and Portugal, addressed to the main stakeholders (key groups) and general public in order to increase the capacity of IAS management. In addition, the project has generated a number of key instruments for improving management and raising awareness of the IAS problem.

2.1. Governance and Research.

The project has worked on governance actions aimed at improving preventive IAS management through work-meetings, forums and workshops with regional and national decision-makers from Spain and Portugal. Specifically, a total of 44 workshops and forums were organized by the Project staff.

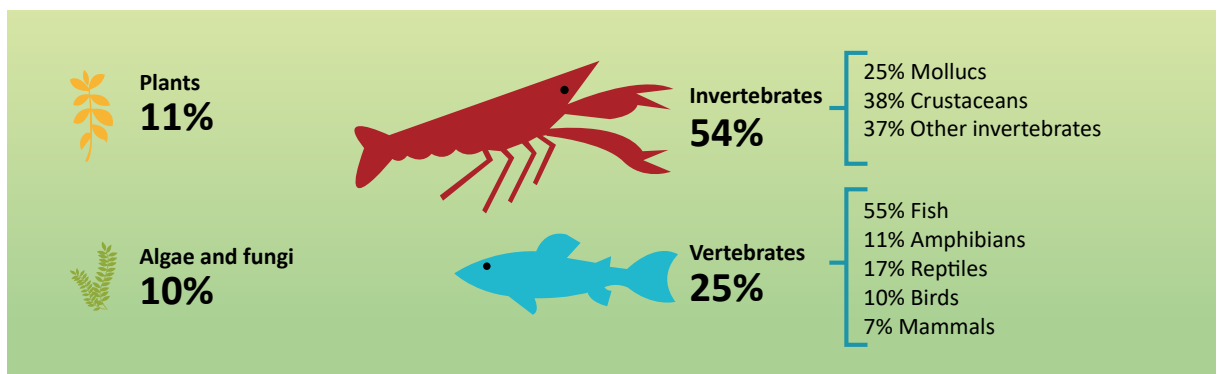
Synergies have also been established between stakeholders directly related to management (Public Administration, Scientific Community and Environmental NGOs) in order to generate updated information and develop instruments that should improve the framework for the prevention and management of IAS in the Iberian Peninsula. At present, the Spanish and Portuguese authorities, in particular, are relying on documents produced by LIFE INVASAQUA to draw up a national strategy for the control of aquatic IAS.

The key instruments developed by the Project should be understood as dynamic tools that will evolve over time according to new situations or scenarios. They were also designed for a participatory process with agency managers and other stakeholders. Finally, it should be noted that one of the objectives of the Project, and therefore of its technical reports and instruments, is to promote collaboration with decision-makers and stakeholders and to ensure information sharing and exchange.

Instruments to the Governance

- **Updated inventories for the Iberian Peninsula**

The **LIFE INVASAQUA** Project has coordinated the updating of inventories on present and potential alien species. The Project supported a participatory method with a group of more than 60 experts to identify issues, agree on methodologies and progress by consensus. The assessment was compiled based on data and knowledge from those experts who represented a large biological invasions expertise in different taxa and with a track record of working in interaction science and management. We followed a structured step-approach combining a systematic review of knowledge on alien species with the collaborative expert identification and consolidation. For its development, workshops and web-meetings were held from January 2019 to October 2020 (updating information in 2022). The outcoming inventories are instruments of scientific consensus concerning species invasion status and are supported by relevant literature and data sources.



Aquatic alien species present in the Iberian Peninsula. Representation by taxonomic groups.



Working meeting with representatives of the public administration in Madrid (MITERD, Spain, May 2023).

¡EVENTO FINAL!

Transferencia del Conocimiento INVASAQUA

EDUCACIÓN Y SENSIBILIZACIÓN SOBRE ESPECIES
INVASoras EN LA PENÍNSULA IBÉRICA



III Knowledge Transfer Forum developed by LIFE INVASAQUA in the National Museum of Natural History (Madrid, September 2023)



Experts participants at the 1st Iberian Lists of aquatic IAS. LIFE INVASAQUA Workshop. (June 2019, Málaga, Spain).

An updated list was developed of the alien species in the establishment or spread invasion stage in inland waters at the Iberian Peninsula: *LIST OF AQUATIC ALIEN SPECIES OF THE IBERIAN PENINSULA - 2020* (Oliva-Paterna et al. 2021a). A total of 326 alien species introduced in Iberian inland waters have been recorded in this study (updating data in Zamora-Marín et al. 2023). In turn, with a similar collaborative procedure, a list of 272 potentially invasive species in the transport or introduction invasion stage and with a future risk of invasion has been identified: *LIST OF POTENTIAL AQUATIC ALIEN SPECIES OF THE IBERIAN PENINSULA - 2020* (Oliva-Paterna et al. 2021b). Most of the taxa included in both lists exhibit invasive behaviour and have a high impact on aquatic ecosystem services and biodiversity in other geographical regions.

Up to the present date, the staff of the Project, with the collaboration of external experts, has also published a scientific paper in the NeoBiota journal updating the list of introduced IAS entitled: *A multi-taxa assessment of aquatic non-indigenous species introduced into Iberian freshwater and transitional waters* (Zamora-Marín et al. 2023).

The updated lists are important instruments to support the implementation of the IAS EU Regulation, also in the EWRR framework, and provide a factual basis for the review of its application. Ultimately, the information included can be used for monitoring the achievement of the target of the EU Biodiversity Strategy to 2030 for combatting IAS, but also for the implementation of other EU policies with requirements on alien species, such as the Birds and Habitats Directives, and the Marine Strategy and Water Framework Directives.

- **Black list and Alert list**

Horizon scanning for high risk IAS is basic when implementing measures to reduce new invasions and to focus efforts on the species already recorded. The LIFE INVASAQUA Project supported, also with a group of external experts, the development of a transnational horizon scanning exercise focused on inland waters of Spain and Portugal in order to provide a black list of current established aquatic IAS and an alert list of potential aquatic IAS that may pose a threat to aquatic ecosystems and socio-economic sectors in the future. We followed a structured 5-steps approach for horizon scanning that combined existing evidence about IAS with an expert scoring of prioritized taxa. The assessment was

summarized in the Technical Report: *BLACK LIST AND ALERT LIST OF THE AQUATIC INVASIVE ALIEN SPECIES OF THE IBERIAN PENINSULA* (Oliva-Paterna et al. 2022).

A total of 126 IAS were prioritised in the final black list or list of concern, representing the 41.2% of alien taxa recorded in Iberian inland waters. The top 24 species had a very high risk of impact because they obtained the maximum values in the risk-assessment scoring process. Some IAS were consistently highlighted as the worst currently recorded in the Iberian inland waters including, among others, the common carp (*Cyprinus carpio*), the largemouth bass (*Micropterus salmoides*), the red swamp crayfish (*Procambarus clarkii*), the zebra mussel (*Dreissena polymorpha*), the water hyacinth (*Eichhornia crassipes* = *Pontaderia crassipes*) and the water fern (*Azolla filiculoides*). In addition, the outcoming alert list included 89 IAS with a relevant risk of invasion in the Iberian Peninsula in the future, resulting in 11 taxa on the top with a very high risk of invasion. Some of those top potential taxa included the quagga mussel (*Dreissena rostriformis bugensis*), the marbled crayfish (*Procambarus virginalis*) (cited later in the Iberian Peninsula), the Amur sleeper (*Perccottus glenii*), and the serpulid tubeworm (*Hydroides dirampha*). Indian swampweed (*Hygrophila polysperma*) and the Carolina fanwort (*Cabomba caroliniana*) were among the worst potential plants with a high probability of future introduction in the Iberian Peninsula which should lead to increased surveillance mechanisms for their possible introduction.

Up to the present date, the staff of the Project, with the collaboration of external experts, has also published a scientific paper in the *Science of the Total Environment* journal with the horizon scan exercise and the priority lists entitled: *A horizon scan exercise for aquatic invasive alien species in Iberian inland waters* (Oficialdegui et al. 2023a).

The resulting black list and alert list are important instruments supporting the implementation of the IAS EU Regulation, because these prioritized lists will help the MS of Spain and Portugal in the establishment of a surveillance system of the key IAS and can foster transnational cooperation and coordination across borders or within shared biogeographical regions. This updated information of IAS could also support IAS policies in multiple ways: providing a scientific basis for the update or development of future legislation; supporting restrictions in specific activities (e.g. species trade); prioritising surveillance, rapid response and mitigation actions.

- **Strategic recommendations for the management**

The **LIFE INVASAQUA** Project developed, also through a participative process with experts, *THE STRATEGIC RECOMMENDATIONS FOR THE TRANSNATIONAL MANAGEMENT OF INVASIVE ALIEN FISH, CRAYFISH AND CRABS* in inland waters of Spain and Portugal (Oliva-Paterna et al. 2023, Oficialdegui et al. 2023b).

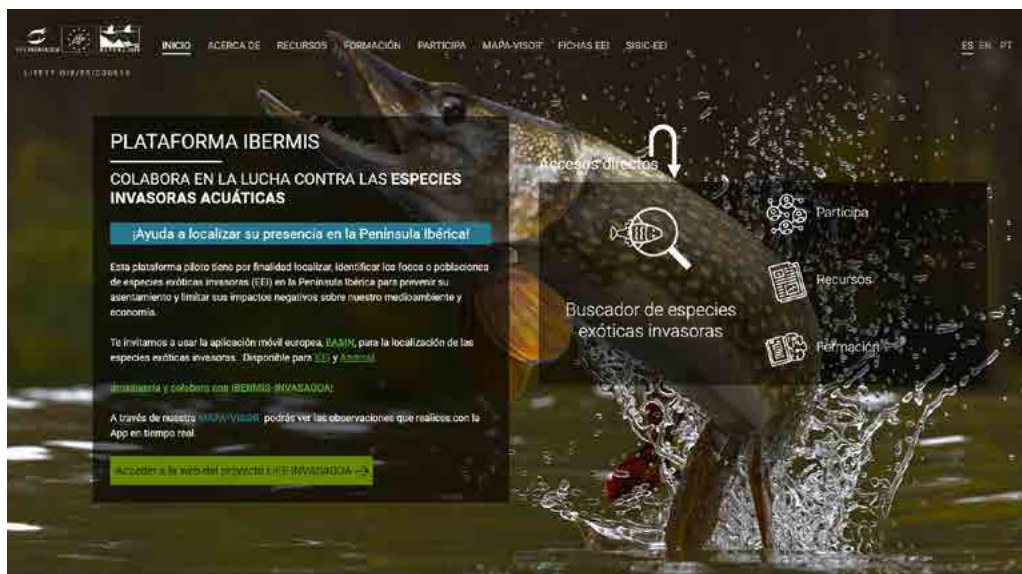
The recommendations promote the coordinated management between Spain and Portugal, in order to facilitate implementation of international commitments and best practices and to support development of policies and targets on invasive fish management. The developed Technical Reports by the Project were designed to serve as guiding documents seeking to identify a strategic direction for the Spanish and Portuguese governance that is already being developed. The resulting recommendations are important instruments also supporting the implementation of the IAS EU Regulation.



Technical reports produced by **LIFE INVASAQUA**: species inventories (present and potential), blacklist, alert list, and strategic recommendations for aquatic IAS management

- **Platforms for knowledge and information transfer**

The **LIFE INVASAQUA** Project has generated and maintains user-friendly online web platforms linked regional, national and transnational information on aquatic IAS. These web platforms facilitate the sharing of data in multiple languages (at least in the official languages of Spain and Portugal). The project generated the Invasive Alien Species web (<https://eei.sibic.org/>) (1,242 users; 5,012 number of unique visits on date 01/October/2023), which includes more than 20,000 geo-referenced records on the monitoring of approximately 200 IAS. In addition, the IBERMIS platform (<https://ibermis.org/>) has been developed to increase citizen collaboration. This web platform is only two years old and has already accumulated a total of 2363 users (2984 number of unique visits) (date 01/October/2023). The project has supported the European Commission's approach to centralising information by linking platforms to the European Alien Species Information Network (EASIN) and promoting the use of the App - Invasive Alien Species Europe.



Invasive Alien Species web platform (<https://eei.sibic.org/>) and the IBERMIS platform (<https://ibermis.org/>) developed by the **LIFE INVASAQUA** Project.

2.2. Disseminations and Training to target groups.

The **LIFE INVASAQUA** Project has developed a disclosure and training strategy in order to access a series of target audiences and key stakeholders considered essential for the management of IAS: surveillance agents, river and estuary users (fishermen, water sports, etc.), knowledge multipliers (museums, aquariums, etc.), the educational groups, the commercial sectors (aquaculture, pet-keeping, etc.), and the media.

Specifically, 98 training events have been carried out, with the direct participation of more than 2,900 people, generating several materials (e.g. best-practices and codes of conduct, etc.) and free online courses (MOOC format) aimed at key groups and available on the project's web platforms (INVASAQUA Official Website <http://www.lifeinvasaqua.com/>; IBERMIS Web-platform <https://ibermis.org/>; Invasive Alien Species web <https://eei.sibic.org/>).



Surveillance agents training courses implemented by the staff of the **LIFE INVASAQUA** Project.

Campaigns with specific materials developed by the Project were organized. Materials such as the information guide entitled *Watch out! Aquatic Invaders* that was performed with a pedagogical purpose. Others are the Review-Clean-Dry documents for users of aquatic systems or codes of conduct and good practices that promote recommendations to reduce the problem of IAS in different contexts. Some of these codes have the support of key groups, for example the *Code of Conduct E-Commerce of Invasive Flora and Fauna* has the support of more than 60 entities that, in addition, join the Stop Invasive Trade campaign. For its part, the *Code of conduct Zoos, Aquariums and Invasive Alien Species in the Iberian Peninsula* has the participation of the Iberian Association of Zoos and Aquariums (AIZA). All of the codes of conduct and good practices generated by the Project are free available on the web platforms.

The education sector (students and teachers) has been one of the focuses of the project, developing activities such as competitions, field practices and communication events in educational centres. In particular, 57 *Youth Engaging Events* at universities and schools were organized by the Project staff. It is worth mentioning the organisation of the *Iberian Youth Conference* in Benavente (Portugal) and the *StudIAS 2022 Congress* in Pamplona (Spain) as the first national congress for secondary school students on exotic species. A *didactic notebook* has also been published in Portuguese and Spanish to work on IAS in the classroom.

Another key element in this area has been the design of the Iberian module of the App *IAS in Europe*: a citizen science tool to involve the public in monitoring invasive species. This module of the App, which aims to involve not only citizens but also key stakeholders in the detection of IAS, was developed under the collaboration of EASIN and the University of Castilla-La Mancha. This module, launched in 2021, has allowed the implementation of various formats (bioblitz-type events, environmental volunteering with NGOs, fishing competitions, etc.) through which a significant increase in knowledge and awareness of the participants has been achieved, as well as the inclusion of new records of aquatic invaders. The information recorded through the App is available on the IBERMIS platform and transferred to the EASIN web platform.

EASIN: Aplicación móvil para Especies Exóticas Invasoras

Ayúdanos en la lucha contra las Especies Exóticas Invasoras

¡DESCÁRGALA HOY!

Promotional image of the App *IAS in Europe* used by the LIFE INVASAQUA Project

2.3. Communication and Awareness.

The **LIFE INVASAQUA** Project has carried out significant communication efforts, aimed at Spanish and Portuguese citizens, with the aim of changing their limited perception and understanding of the ecological and socio-economic threats posed by IAS, which is an added difficulty when implementing management and control policies for these species. In conjunction with dissemination and training activities, the Project has organized and/or participated in 598 multi-category events and activities of communication and awareness, 438 of these (73.2%) organized by the project itself, with a total of 246,148 people attended all of them (TABLE 1) (for information of the Project impact see Oliva-Paterna et al. 2024). In terms of people attended, in addition to the general public, the scope of the project has had an important impact on stakeholders directly involved in IAS management (Public Administration, Scientific Community and NGOs), as well as on key sectors such as surveillance agents, the education sector and environmental journalists. Also in terms of institutions involved we have also worked with a significant number of river and estuary users and knowledge multipliers (TABLE 1).

TABLE 1. People and institutions reached in the total Events & Activities of the LIFE INVASAQUA Project

Category of stakeholders involved	Persons	Institutions
Public Administration	3,111	77
Scientific Community (Universities & Research Centers)	4,166	80
Environmental NGOs & Consultancies.	1,304	59
Surveillance Agents	1,428	9
River & Estuary users	387	55
Knowledge multipliers (Environmental educators, Museums, Aquariums, etc.)	968	49
Educational sector	48,244	81
Commercial and business sector	473	16
Media and environmental journalists	1,074	6
General Public (conservative estimates)	184,993	(--)
TOTAL	246,148	481



Work-meeting with national officials responsible for IAS management from public administrations (MITERD, Madrid, May 2023)..

Mass raise-awareness campaigns have also been launched on key stakeholders and on different groups of the population through social networks with the intention of both disseminating the problem of IAS and spreading the events, resources, and activities that the project. A total of 11,780 followers on social networks (5,832 Twitter-X - 1,168 Facebook - 3700 LinkedIn - 1089 Instagram) (date 01/October/2023) and the 120,727 users of the project’s official website (mentioned above) have been very useful to increase the channels of communication and dissemination among different profiles and social sectors. Twitter-X was the most followed social network of the project with a very steady trend of increasing follower numbers and a reach of a total of 2,329,400 impressions (FIGURE 2).

The official web platform of the **LIFE INVASAQUA** project (<http://www.lifeinvasaqua.com/>) has also been an essential instrument for the visibility of the project and for the raise-awareness campaigns. This official Project website has registered a total of 120,727 users and a total of 574,727 visits (244,758 number of unique visits) (date 01/October/2023), with an exponential trend in the general use of the site (FIGURE 2). In addition to including free downloads of all the documentation generated by the project, the website, together with the social networks, has also been the main instrument for the dissemination of publications, news and multimedia materials developed by the Project.

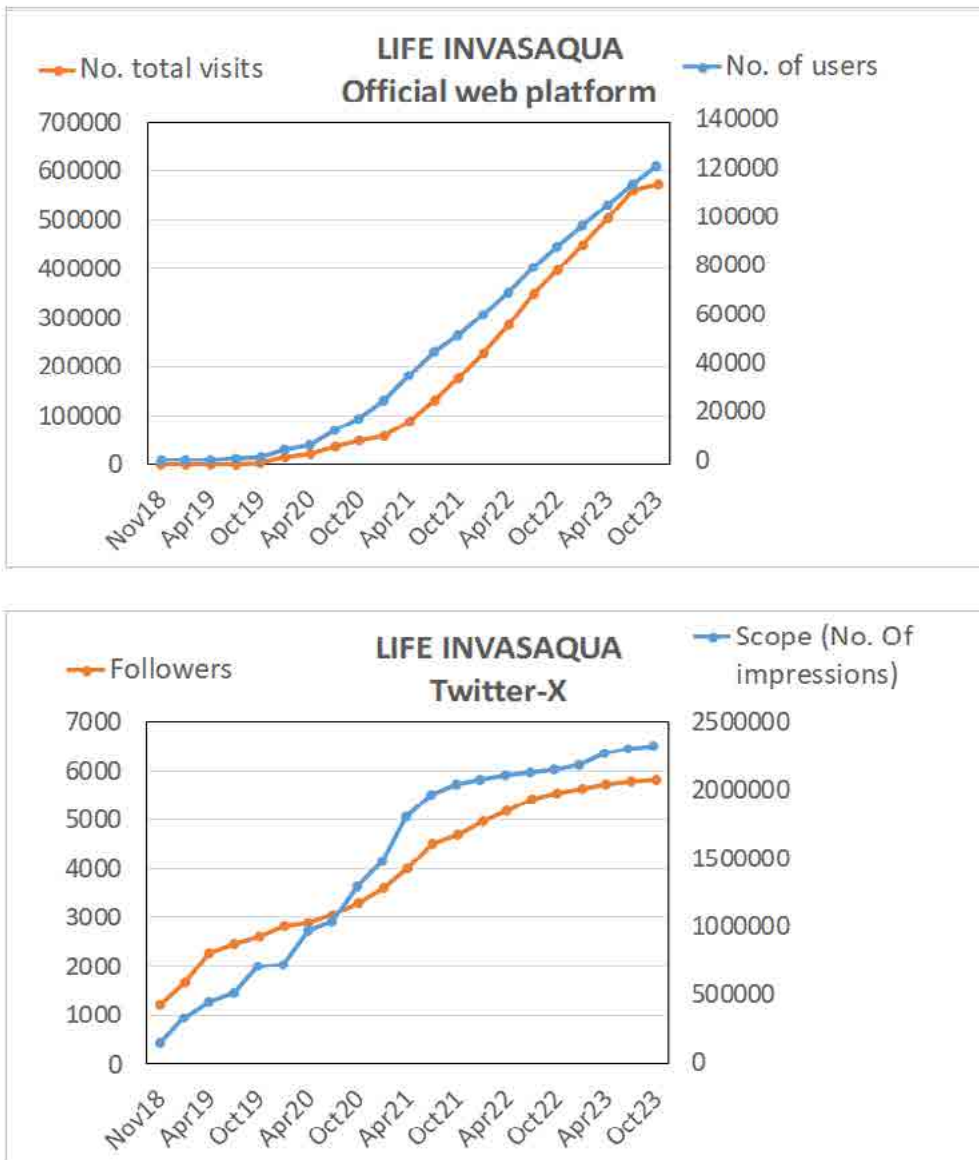


FIGURE 2. Temporal trends in users of the official web platform (a total of 120,727 users) and followers on the project site in the social network Twitter-X (5,832 total followers) (date 01/October/2023). Modified from Oliva-Paterna et al. (2024).

The multimedia and audio-visual materials for communication and transfer were also one of the tools aimed at awareness-raising and outreach. The Project has produced more than 160 materials, including, among other formats, interviews in podcast, informative videos regarding to key stakeholders, animation videos on IAS problems, as well as multimedia reports on priority IAS in Spain and Portugal. For instance, both the record of the total number of visualisations (49,801 registered web-views) and the increase trends of views of some of these materials (Official video of the Project, Multimedia reports, Animation videos) (see in Oliva-Paterna et al. 2024) reflected the usefulness that this multimedia instrument have had for the visibility of the Project and for raising awareness on IAS issues.

In some activities aimed at the general public, we have worked with conservative estimates of attendees. For example, it is estimated that there were more than 150,000 visitors to the museum exhibition *Watch out! Aquatic invaders*, which opened at the National Museum of Natural Sciences (Madrid, Spain) in January 2020 and, since then, has been displayed in more than 20 different locations in Spain and Portugal. Additionally, this exhibition has been replicated by Public Administration entities such as the Júcar River Basin Authority for use in areas of the Spanish east coast.



Museum exhibition *Watch out! Aquatic Invaders* developed by the Natural Museum of Natural Sciences from Spain (MNCN-CSIC).

The project has participated in massive events such as the Science and Technology Week or the World Rivers Day. Three editions of a short *film competition on IAS* have been developed by the staff of the Project and we have co-organised three editions of *the Invasive Species Week in Portugal & Spain (SEI)*, an awareness marathon that in 2023 has involved 250 entities and more than 2,800 participants.



Representative pictures from the editions of *the Invasive Species Week in Portugal & Spain (SEI)*.

To design and implement adequate communication plans, stakeholders' perceptions and risk behaviours regarding IAS were monitored by surveys (questionnaires) during the **LIFE INVASAQUA** Project. Specific information on the design, structure and question composition of the survey is detailed in the preliminary evaluation study developed by the project (Banha et al. 2022). Data was collected since February 2019 and April 2019 in Portugal and Spain, respectively, until the end of the project (September 2023). The total number of responded surveys obtained from the different versions was 7078, and were received from all Portuguese and Spanish administrative regions. The most participative stakeholders and target groups, on whom the project has made the greatest effort to obtain results, were rivers and estuaries users and the educational sector. At first part of the Project, we found differences in IAS' awareness between countries, and between different stakeholder groups. The initial results also showed that the awareness of socioeconomic and human health impacts was substantially lower when compared with impacts on biodiversity (Banha et al. 2022). This type of information was useful for the Project team to focus activities, events and materials developed by the Project. At the same time, the perception of people who answered that they knew or had heard about the project, has been steadily increasing over the years. In other words, in the year 2023, 64% of the people who responded to the surveys already knew about the **LIFE INVASAQUA**, while in the first year (2019), only 37% knew about the project, showing that the visibility of the **LIFE INVASAQUA** project has grown over the implementation period. Our final results revealed an increase in awareness of all IAS impacts, diminishing the differences in perception between biodiversity, socioeconomic and human health impacts, showing or revealing some success in our awareness-raising actions.

2.4. Transferability and Replicability.

The **LIFE INVASAQUA** Project was designed from the beginning with a clear vocation for knowledge transfer and with the intention of facilitating its transferability and replicability, objectives in which it has found the collaboration of multiple entities and academic societies.

Replicability and transferability plans from projects are key instruments to improve the management efforts by using practices, methodologies and actions already successfully implemented as part of a given project. Accordingly, the Project has developed a *Transferability and Replicability Plan* (IUCN & UMU, 2023) to ensure that main results can be transferred and replicated in other contexts and locations, thus maximising impact and long-term sustainability. The Plan identifies key elements of the Project that have potential for transfer or replication that may include technologies, methodological approaches, best practices or collaboration models, among others. In addition, the Plan includes applicable recommendations to prepare the ground for the implementation of the project interventions elsewhere, as well as to serve as a guidance document throughout the implementation of other LIFE projects in order to integrate transferability and replicability actions into preparatory, conservation and dissemination actions.

Multiple entities, projects and academic societies have collaborated in transferring information, in facilitating the replication of project actions in different contexts, and in the development of events for the exchange of experiences. It is worth highlighting that, together with the GEIB (Group of Specialists in Biological Invasions) and the Science Museum of the University of Navarra, **LIFE INVASAQUA** has co-organised the *VI National Congress and I Iberian Congress on Invasive Alien Species* (EEI 2022) held in Pamplona, April 2022. In addition, it has organised special sessions and workshops on IAS in different Iberian congresses (RestauraRios Congresses 2019 and 2023, Ichthyology Congresses SIBIC-2020 and SIBIC-2022, Limnology Congress AIL-2020). The project has granted scholarships to more than 40 students and young researchers to facilitate their participation in several of these congresses and conferences. In addition, two international events were organised in Malaga and Brussels with the presence of European projects and entities related to the IAS.



VI National Congress and I Iberian Congress on Invasive Alien Species (EEI 2022) (Pamplona, April 2022).

During the implementation of the Project, mainly in its last years, several events have been organised to promote and facilitate the transfer of knowledge, information and instruments developed to key stakeholders, especially for responsible of IAS management and decision making. The most relevant were the *INVASAQUA Knowledge Transfer Forums* (three events organized in the Spanish National Museum of Natural History, Madrid, Spain) and the networking events “*Exchanging Experiences on IAS Projects in Europe: Lessons Learned*” (Málaga, May 2023) and “*Addressing IAS in Europe: The relevance of transnational cooperation and the stakeholder engagement*” (Brussels, September 2023), in which the key results and material for transfer were presented to transnational project representatives and to several National and European authorities.



International networking events “*Exchanging Experiences on IAS Projects in Europe: Lessons Learned*” (Málaga, May 2023).



3

Outcomes and lessons learned

Information, training, and public raise-awareness campaigns are essential for society to become aware of the problems posed by IAS and acquire the necessary tools to make informed decisions and responsible measures. In addition, providing up-to-date information is an essential requirement to achieve the EU and global biodiversity targets, particularly in the light of the IAS Regulations.

3.1. Tangible Results and Lessons Learned.

The **LIFE INVASAQUA** Project has proved to be an important instrument of awareness of IAS within Spain and Portugal, but also extensible to other MS, supporting the IAS EU Regulation by engaging and creating synergies among knowledge building, management decision-makers and stakeholders.

The Project has also proved to be a good source of information to support the implementation of the IAS Regulations, not only European, but also Spanish and Portuguese, providing tools for this and factual basis for the review of regional enforcement. The information provided by INVASAQUA's actions is essential to support decision making on IAS that affect -or have the potential to do so- the Iberian inland waters, and to ensure an optimal use of the resources invested in prevention and early detection of potential invaders. However, given the increase in the number of alien species that are and will likely be introduced in the coming decades (Seebens et al. 2021), it is needed to regularly review and update the information and continue energetically to raise awareness of the IAS problem.

According to some of the main implemented actions (A. Preliminary Actions; B. Core Actions; and C. Replicability and Transferability Actions), the ANNEX of this Technical Report is a summary list of tangible results and some lessons learned achieved during the implementation of the LIFE INVASAQUA Project (2019-2023).

The key success factors of the impact of the Project can be summarized in the following arguments:

- The information updates and management tools developed by **LIFE INVASAQUA** provide a useful and replicable basis for the review of the application of the regulation throughout Europe.
- The information generated provides a scientific basis for the review of the legislation on IAS and for setting priorities in surveillance and mitigation actions.
- The formation of groups of experts has proven to be a very effective way of updating and developing scientific and technical knowledge.
- The involvement of key sectors and stakeholders in the development of educational and informative resources has proven to be an enriching approach to ensure the quality and utility of them.
- The instruments and resources generated by the Project have been oriented towards a series of key groups and stakeholders, which has significantly increased their interest and reach.

BOX 3.

Project Impact – By the Numbers

- More than 246,000 people attended all activities, more than 150,000 visitors to the museum exhibition *Watch out! Aquatic Invaders*.
- 598 events and activities (transfer and training workshops, dissemination and communication events, etc.).
- More than 470 institutions or other organisations participating in events and actions.
- More than 700 publications and news on the IAS.
- More than 20 scientific-technical documents for transfer to managers and other key stakeholders.
- More than 11,700 followers on social networks (Twitter-X was reached of a total of 2,329,400 impressions) and more than 120,000 Official project-website users.
- More than 7,000 surveys (questionnaires) to evaluate the perception regarding IAS in the Iberian Peninsula.

3.2. Long-term Outcomes.

The expected overall aims of the project are to reduce the likelihood of new aquatic IAS colonisations in the Iberian Peninsula and to improve the effectiveness of the management of the established ones. All of this is based on increased education and awareness of the general public and key stakeholder groups in the management and solution of the IAS problem. We believe that the specific objectives to achieve this final result have been met, although the real effect will be felt in the long term as a consequence of the synergy with other European and Iberian initiatives together with the following achievements of the **LIFE INVASAQUA** project:

- Improved implementation of the EU IAS Regulation through the creation of instruments and materials, the development of management strategies and increased training of managers and decision-makers, NGO and consultancy professionals and researchers.
- Improving Iberian IAS effective management by creating synergies between stakeholders, establishing long-term cooperation and data exchange at national and transnational level.
- Raising awareness among stakeholders and key target groups, with specific events and training courses, so that they understand why prevention is necessary.
- Creation of open access information and communication materials that actively promote the adoption of best practices by key target groups.
- Increased information and awareness of the general public, mainly through mass communication campaign and the organisation of specific events. But also with materials and web platforms aimed at disseminating and raising awareness of the IAS problem in society.

Although IAS in Iberian aquatic ecosystems continues to be a growing problem, we hope that the effort made by the LIFE INVASAQUA Project will make our society more aware of the problem and with a greater capacity to manage it.



Final event of the **LIFE INVASAQUA** Project in Portugal (September 2023, Lisboa). (c) LIFE INVASAQUA

References

- Angulo E., Ballesteros-Mejia L., Novoa A., Duboscq-Carra V.G., Diagne C., F. Courchamp. 2021. Economic costs of invasive alien species in Spain. *NeoBiota* 67: 267–297.
- Banha F., Diniz A.M., P.M. Anastácio. 2017. The role of anglers’ perceptions and habits in biological invasions: perspectives from the Iberian Peninsula. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 27(1), pp. 51-64.
- Banha F., Diniz A.M., Olivo del Amo R., Oliva-Paterna F.J., P.M. Anastácio. 2022. Perceptions and risk behaviors regarding biological invasions in inland aquatic ecosystems. *Journal of Environmental Management*, 308, 114632.
- Baquero R., Ayllón D., Oficialdegui F., G. Nicola. 2021. Tackling biological invasions in Natura 2000 network in the light of the new EU Biodiversity Strategy for 2030. *Management of Biological Invasions* 12(4): 776–791.
- Caffrey J.M., J.R. Baars, J.H. Barbour, P. Boets, P. Boon, K. Davenport, J.T.A. Dick, J. Early, L. Edsman, C. Gallagher, J. Gross, P. Heinimaa, C. Horrill, S. Hudin, P.E. Hulme, S. Hynes, H.J. MacIsaac, P. McLoone, M. Millane, T.L. Moen, N. Moore, J. Newman, R. O’Conchuir, M. O’Farrell, C. O’Flynn, B. Oidtmann, T. Renals, A. Ricciardi, H. Roy, R. Shaw, O. Weyl, F. Williams, F.E. Lucy. 2014. Tackling invasive alien species in Europe: the top 20 issues. *Management of Biological Invasions*, 5 (1): 1-20.
- Cuthbert R.N., Pattison Z., Taylor N.G., Verbrugge L., Diagne C., Ahmed D.A., Leroy B., Angulo E., Briski E., Capinha C., Catford J.A., Dalu T., Essl F., Gozlan R.E., Haubrock P.J., Kourantidou M., Kramer A.M., Renault D., Courchamp F. 2021. Global economic costs of aquatic invasive alien species. *Science of the Total Environment* 775: 145238.
- Diagne C., Leroy B., Vaissière A.C., Gozlan R.E., Roiz D., Jarić I., Salles J.M., Bradshaw C.J.A. and F. Courchamp. 2021. High and rising economic costs of biological invasions worldwide. *Nature*, 592, 571-576.
- EASIN. 2023. European Commission - Joint Research Centre - European Alien Species Information Network (EASIN).
- EU Regulation 1143/2014. Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species. *Official Journal of the European Union*, 57.
- Faulkner K.T., Robertson M.P., J.R.U. Wilson. 2020. Stronger regional biosecurity is essential to prevent hundreds of harmful biological invasions. *Global Change Biology* 26(4): 2449–2462.
- Flood P.J., Duran A., Barton M., Mercado-Molina A.E., Trexler J.C. 2020. Invasion impacts on functions and services of aquatic ecosystems. *Hydrobiologia*, 847: 1571–1586.
- Gallardo, B., Clavero, M., Sánchez, M.I., Vilà, M. 2016. Global ecological impacts of invasive species in aquatic ecosystems. *Global Change Biology*, 22(1), 151-163.
- Gallardo, B., Bogan, A. E., Harun, S., Jainih, L., Lopes-Lima, M., Pizarro, M., Rahim, K.A., Sousa, R., Virdis, S.G.P. Zieritz, A. 2018. Current and future effects of global change on a hotspot’s freshwater diversity. *Science of the Total Environment*, 635, 750-760.
- Genovesi P., C. Shine. 2011. *European Strategy on Invasive Alien Species*. *Nature and Environment*, No. 161. Council of Europe.

- Genovesi P., Carboneras C., Vilà M., Walton P. 2015. EU adopts innovative legislation on invasive species: a step towards a global response to biological invasions? *Biological Invasions*, 17: 1307-1311.
- Guareschi S., Laini A., England J., Barrett J., P.J. Wood. 2021. Multiple co-occurrent alien invaders constrain aquatic biodiversity in rivers. *Ecological Applications* 31(6): e02385.
- Hulme, P.E. 2021. Unwelcome exchange: International trade as a direct and indirect driver of biological invasions worldwide. *One Earth*, 4(5), 666-679.
- IPBES. 2023. *Summary for Policymakers of the Thematic Assessment Report on Invasive Alien Species and their Control of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. Roy, H. E., Pauchard, A., Stoett, P., Renard Truong, T., Bacher, S., Galil, B. S., Hulme, P. E., Ikeda, T., Sankaran, K. V., McGeoch, M. A., Meyerson, L. A., Nuñez, M. A., Ordonez, A., Rahlao, S. J., Schwindt, E., Seebens, H., Sheppard, A. W., and Vandvik, V. (eds.). IPBES secretariat, Bonn, Germany. <https://doi.org/10.5281/zenodo.7430692>
- IUCN, 2020. IUCN EICAT Categories and Criteria. The Environmental Impact Classification for Alien Taxa. First edition. Gland, Switzerland and Cambridge, UK: IUCN.
- IUCN and UMU. 2023. *LIFE INVASAQUA. Transferability and replicability plan*. Technical document of the LIFE INVASAQUA project (LIFE17 GIE/ES/000515). Málaga, Spain: Centre for Mediterranean Cooperation.
- McFadden I.R., Sendek A., Brosse M., Bach P.M., Baity-Jesi M., Bolliger J., Bollmann K., Brockerhoff EG, Donati G, Gebert F, Ghosh S, Ho H, Khaliq I, Lever JJ, Logar I, Moor H, Odermatt D, Pellissier L, de Queiroz LJ, Rixen C, Schuwirth N, Shipley JR, Twining CW, Vitasse Y, Vorburger C, Wong MKL, Zimmermann NE, Seehausen O, Gossner MM, Matthews B., Graham C.H., Altermatt F., A. Narwani. 2023. Linking human impacts to community processes in terrestrial and freshwater ecosystems. *Ecology Letters* 26(2): 203–218.
- Nunes A.L., Tricarico E., Panov V.E., Cardoso A.C., Katsanevakis S. 2015. Pathways and gateways of freshwater invasions in Europe. *Aquatic Invasions*, 10: 359–370.
- Oficialdegui F.J., Zamora-Marín J.M., Guareschi S., Anastácio P.M., García-Murillo P., Ribeiro F., Miranda R., Cobo F., Gallardo B., García-Berthou E., Boix D., Arias A., Cuesta J.A., Medina L, Almeida D, Banha F, Barca S, Biurrun I, Cabezas M.P., Calero S., Campos JA, Capdevila-Argüelles L, Capinha C, Casals F, Clavero M, Encarnação J, Fernández-Delgado C., Franco J, Guillén A, Hermoso V, Machordom A., Martelo J., Mellado-Díaz A., Morcillo F., Oscoz J., Perdices A., Pou-Rovira Q, Rodríguez-Merino A., Ros M, Ruiz-Navarro A, Sánchez MI, Sánchez-Fernández D, Sánchez-González J.R., Sánchez-Gullón E., Teodósio M.A., Torralva M., Vieira-Lanero R., F.J. Oliva-Paterna FJ. 2023a. A horizon scan exercise for aquatic invasive alien species in Iberian inland waters. *The Science of the Total Environment* 869: 161798.
- Oficialdegui F.J., Anastácio P.M., Miranda R., Cobo F., González-Ortegon E., Zamora-Marín J.M., Arias A., Benejam L., Banha F., Clavero M., Cuesta J.A., Oscoz J., Pou-Rovira Q., F.J. Oliva-Paterna. 2023b. *STRATEGIC RECOMMENDATIONS FOR THE TRANSNATIONAL MANAGEMENT OF INVASIVE ALIEN CRAYFISH AND CRABS IN IBERIAN INLAND WATERS*. Technical Report prepared by LIFE INVASAQUA (LIFE17 GIE/ES/000515).
- Oliva-Paterna F.J., Ribeiro F., Miranda R., Anastácio P.M., García-Murillo P., Cobo F., Gallardo B., García-Berthou E., Boix D., Medina L., Morcillo F., Oscoz J., Guillén A., Arias A., Cuesta J.A., Aguiar F., Almeida D., Ayres C., Banha F., Barca S., Biurrun I., Cabezas M.P., Calero S., Campos J.A., CapdevilaArgüelles L., Capinha C., Carapeto A., Casals F., Chainho P., Cirujano S., Clavero M., Del Toro V., Encarnação J.P., Fernández-Delgado C., Franco J., García-Meseguer A.J., Guareschi S., Guerrero A., Hermoso V., Machordom A., Martelo J., Mellado-Díaz A., Moreno J.C., Oficialdegui F.J., Olivo del Amo

R., Otero J.C., Perdices A., Pou-Rovira Q., Rodríguez-Merino A., Ros M., Sánchez-Gullón E., Sánchez M.I., Sánchez-Fernández D., Sánchez-González J.R., Soriano O., Teodósio M.A., Torralva M., Vieira-Lanero R., Zamora-López, A. & Zamora-Marín J.M. 2021a. *LIST OF AQUATIC ALIEN SPECIES OF THE IBERIAN PENINSULA 2020. Updated list of the aquatic alien species introduced and established in Iberian inland waters*. Technical Report prepared by LIFE INVASAQUA (LIFE17 GIE/ES/000515). 64pp.

■ Oliva-Paterna F.J., Ribeiro F., Miranda R., Anastácio P.M., García-Murillo P., Cobo F., Gallardo B., García-Berthou E., Boix D., Medina L., Morcillo F., Oscoz J., Guillén A., Arias A., Cuesta J.A., Aguiar F., Almeida D., Ayres C., Banha F., Barca S., Biurrun I., Cabezas M.P., Calero S., Campos J.A., Capdevila-Argüelles L., Capinha C., Carapeto A., Casals F., Chainho P., Cirujano S., Clavero M., Del Toro V., Encarnação J.P., Fernández-Delgado C., Franco J., García-Meseguer A.J., Guareschi S., Guerrero A., Hermoso V., Machordom A., Martelo J., Mellado-Díaz A., Moreno J.C., Oficialdegui F.J., Olivo del Amo R., Otero J.C., Perdices A., Pou-Rovira Q., Rodríguez-Merino A., Ros M., Sánchez-Gullón E., Sánchez M.I., Sánchez-Fernández D., Sánchez-González J.R., Soriano O., Teodósio M.A., Torralva M., Vieira-Lanero R., Zamora-López, A. & Zamora-Marín J.M. 2021b. *LIST OF POTENTIAL AQUATIC ALIEN SPECIES OF THE IBERIAN PENINSULA 2020. Updated list of the potential aquatic alien species with high risk of invasion in Iberian inland waters*. Technical Report prepared by LIFE INVASAQUA (LIFE17 GIE/ES/000515). 60pp.

■ Oliva-Paterna F.J., Oficialdegui F.J., Anastácio P.M., García-Murillo P., Zamora-Marín J.M., Ribeiro F., Miranda R., Cobo F., Gallardo B., García-Berthou E., Boix D., Medina L., Arias A., Cuesta J.A., Almeida D., Banha F., Barca S., Biurrun I., Cabezas M.P., Calero S., Campos J.A., Capdevila-Argüelles L., Capinha C., Casals F., Clavero M., Encarnação J.P., Fernández-Delgado C., Franco J., Guareschi S., Guillén A., Hermoso V., López-Cañizares C., Machordom A., Martelo J., Mellado-Díaz A., Morcillo F., Olivo del Amo R., Oscoz J., Perdices A., Pou-Rovira Q., Rodríguez-Merino A., Ros M., Ruiz-Navarro A., Sánchez-Gullón E., Sánchez M.I., Sánchez-Fernández D., Sánchez-González J.R., Teodósio M.A., Torralva M., Vieira-Lanero R. 2022. *BLACK LIST AND ALERT LIST OF THE AQUATIC INVASIVE ALIEN SPECIES OF THE IBERIAN PENINSULA. Horizon scanning exercise focused on the high-risk aquatic invasive alien species for the Iberian inland waters*. Technical Report prepared by LIFE INVASAQUA (LIFE17 GIE/ES/000515). 57 pp.

■ Oliva-Paterna F.J., Oficialdegui F.J., Sánchez-González J.R., Zamora-Marín J.M., Casals F., Ribeiro F., Torralva M., Miranda R., Guerreiro P.M., Almeida D., Alexandre C.M., Benejam L., Clavero M., Cobo F., Doadrio I., Fernández-Delgado C., García-Berthou E., Godinho F.N., González G., Magalhães M.F., Morcillo F., Perdices A., Pou-Rovira Q., Santos J.M., Vila-Gispert A. and L. Zamora. 2023. *STRATEGIC RECOMMENDATIONS FOR THE TRANSNATIONAL MANAGEMENT OF INVASIVE ALIEN FISH IN IBERIAN INLAND WATERS*. Technical Report prepared by LIFE INVASAQUA (LIFE17 GIE/ES/000515).

■ Oliva-Paterna F.J., Olivo del Amo R., López-Cañizares C., Guillén-Beltrán A., Banha F., Brandão P., P.M. Anastácio. 2024. *LIFE INVASAQUA - AQUATIC INVASIVE ALIEN SPECIES OF FRESHWATER AND ESTUARINE SYSTEMS: AWARENESS AND PREVENTION IN THE IBERIAN PENINSULA. PROJECT VISIBILITY, IMPACT & LESSONS LEARNED*. Technical Report prepared by LIFE INVASAQUA (LIFE17 GIE/ES/000515).

■ Reaser J.K., Frey M., Meyers N.M. 2020. Invasive species watch lists: guidance for development, communication, and application. *Biological Invasions*, 22: 47–51.

■ Ruiz-Navarro A., Esteve P., Banos-González, F. Díaz-Tárraga. 2023. Students' perceptions of the presence of feral exotic pets and influencing factors. *Journal of Biological Education*.

■ Seebens H., Blackburn T.M., Dyer E.E., Genovesi P., Hulme P.E., Jeschke J.M., Pagad S., Pyšek P., Winter M., Arianoutsou M., Bacher S., Blasius B., Brundu G., Capinha C., Celesti-Grappo L., Dawson W., Dullinger S., Fuentes N., Jäger H., Kartesz J., Kenis M., Kreft H., Kühn I., Lenzner B., Liebhold A., Mosena A., Moser D., Nishino M., Pearman D., Pergl J., Rabitsch W., Rojas-Sandoval J., Roques A., Rorke S., Rossinelli S., Roy H.E., Scalera R., Schindler S., Štajerová K., Tokarska-Guzik B., van Kleunen M., Walker K., Weigelt P., Yamanaka T., Essl F. 2017. No saturation in the accumulation of alien species worldwide. *Nature Communications*, 8: 1-9.

■ Seebens H., Bacher S., Blackburn T.M., Capinha C., Dawson W., Dullinger S., Genovesi P., Hulme P.E., van Kleunen M., Kühn I., Jeschke J.M., Lenzner B., Liebhold A.M., Pattison Z., Pergl J., Pyšek P., Winter M. and F. Essl. 2021. Projecting the continental accumulation of alien species through to 2050. *Global Change Biology*. 27, 970-982.

■ Simberloff D., Jean-Louis M., Genovesi P., Maris V., Wardle D.A., Aronson J., Courchamp F., Galil B., García-Berthou E., Pascal M., Pyšek P., Sousa R., Tabacchi E., Vilà M. 2013. Impacts of biological invasions: what's what and the way forward. *Trends in Ecology & Evolution*, 28: 58-66.

■ Zamora-Marín J.M., A. Ruiz-Navarro, F.J. Oficialdegui, P.M. Anastácio, R. Miranda, P. García-Murillo, F. Cobo, F. Ribeiro, B. Gallardo, E. García-Berthou, D. Boix, L. Medina, F. Morcillo, J. Oscoz, A. Guillén, A.A. Herrero-Reyes, F.C. Aguiar, D. Almeida, A. Arias, C. Ayres, F. Banha, S. Barca, I. Biurrun, M.P. Cabezas, S. Calero, J.A. Campos, L. Capdevila-Argüelles, C. Capinha, A. Carapeto, F. Casals, P. Chainho, S. Cirujano, M. Clavero, J.A. Cuesta, V. Deltoro, J. Encarnação, C. Fernández-Delgado, J. Franco, A.J. García-Meseguer, S. Guareschi, A. Guerrero-Gómez, Virgilio Hermoso, C. López-Cañizares, J. López-Soriano, A. Machordom, J. Martelo, A. Mellado-Díaz, Juan C. Moreno, R. Olivo del Amo, J.C. Otero, A. Perdices, Q. Pou-Rovira, S. Quiñonero-Salgado, A. Rodríguez-Merino, M. Ros, E. Sánchez-Gullón, Marta I. Sánchez, D. Sánchez-Fernández, J.R. Sánchez-González, O. Soriano, M. Alexandra Teodósio, M. Torralva, R. Vieira-Lanero, A. Zamora-López, F.J. Oliva-Paterna. A multi-taxa assessment of aquatic non-indigenous species introduced into Iberian freshwater and transitional waters. *NeoBiota*, 89: 17-44.



Student engaging event of the **LIFE INVASAQUA** Project at the University of Murcia (Murcia, May 2019).

List of Author affiliations

■ **Anastácio, Pedro M.**

MARE – Centro de Ciências do Mar e do Ambiente.
Departamento de Paisagem, Ambiente e Ordenamento.
Escola de Ciências e Tecnologia. Universidade de Évora, Évora (Portugal).

■ **Banha, Filipe**

MARE – Centro de Ciências do Mar e do Ambiente.
Departamento de Paisagem, Ambiente e Ordenamento.
Escola de Ciências e Tecnologia. Universidade de Évora, Évora (Portugal).

■ **Barca, Sandra**

Departamento de Zooloxía, Xenética e Antropoloxía Física.
Facultade de Bioloxía. Laboratorio de Hidrobioloxía.
Universidade de Santiago de Compostela, A Coruña (Spain).

■ **Brandão, Pedro**

MARE – Centro de Ciências do Mar e do Ambiente.
Departamento de Paisagem, Ambiente e Ordenamento.
Escola de Ciências e Tecnologia. Universidade de Évora, Évora (Portugal).

■ **Casals, Frederic**

Departament de Ciència Animal. Universitat de Lleida, Lleida (Spain).
Centre Tecnològic Forestal de Catalunya (CTFC), Solsona, Lleida (Spain).

■ **Clavero, Helena**

IUCN Centre for Mediterranean Cooperation
Málaga (Spain).

■ **Cobo, Fernando**

Departamento de Zooloxía, Xenética e Antropoloxía Física.
Facultade de Bioloxía. Laboratorio de Hidrobioloxía.
Universidade de Santiago de Compostela, A Coruña (Spain).

■ **Guillén Beltrán, Antonio**

Departamento de Zoología y Antropología Física.
Facultad de Biología. Universidad de Murcia, Murcia (Spain).

■ **López Cañizares, Celia**

Departamento de Zoología y Antropología Física.
Facultad de Biología. Universidad de Murcia, Murcia (Spain).

■ **Miranda, Rafael**

Departamento de Biología Ambiental.
Universidad de Navarra, Pamplona (Spain).

■ **Numa, Catherine**

IUCN Centre for Mediterranean Cooperation
Málaga (Spain).

■ **Oliva-Paterna, Francisco J**

Departamento de Zoología y Antropología Física.
Facultad de Biología. Universidad de Murcia, Murcia (Spain).

■ **Olivo del Amo, Rosa**

Departamento de Zoología y Antropología Física.
Facultad de Biología. Universidad de Murcia, Murcia (Spain).

■ **Oscóz, Javier**

Departamento de Biología Ambiental.
Universidad de Navarra, Pamplona (Spain).

■ Perdices, Anabel

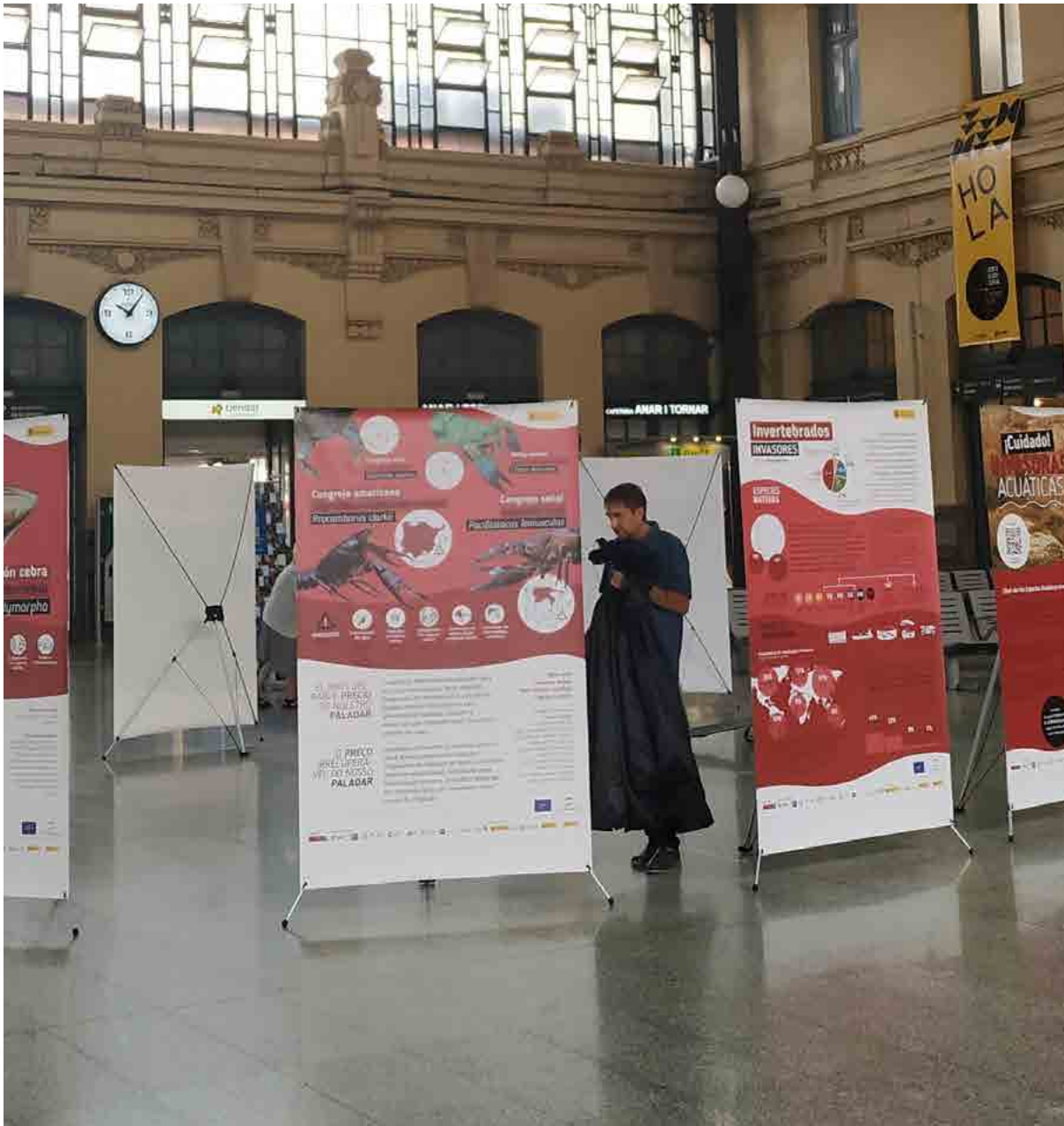
Departamento de Biodiversidad y Biología Evolutiva.
Museo Nacional de Ciencias Naturales - CSIC. Madrid (Spain).

■ Ribeiro, Filipe

MARE – Centro de Ciências do Mar e do Ambiente.
Faculdade de Ciências da Universidade de Lisboa, Lisboa (Portugal).

■ Torralva, Mar

Departamento de Zoología y Antropología Física.
Facultad de Biología. Universidad de Murcia, Murcia (Spain).



A replicate of the exhibition Watch out! Aquatic Invaders installed at the main train station in Valencia thanks to the Confederación Hidrográfica del Júcar - CHJ (Valencia, September 2022).

ANNEX – Tangible Results & Lessons Learned by LIFE INVASAQUA

Actions

According to some of the main implemented actions, the following is a summary list of tangible results and some lessons learned achieved during the implementation of the LIFE INVASAQUA Project (2019-2023).

A. PRELIMINARY ACTIONS

A.1. Communication Plan	
Tangible results	Lessons learned
<p>Baseline information about perception and knowledge regarding aquatic IAS of the iberian society.</p> <p>--This goal was achieved with the Spanish and Portuguese general public baseline knowledge addressed with a comprehensive online search and with the preliminary study of perception (with surveys or awareness questionnaires) regarding IAS developed by the Project (Banha et al. 2022).</p> <p>Project Communication Plan.</p> <p>-- A coordinated and planned methodology for the development of dissemination and communication activities and materials. Among others, this communication plan included the corporative image of the project in a consensus process with partners, communication strategies for the raise-awareness campaigns in different languages (e.g. Check-Clean-Dry Campaign, STOP IAS Campaign, etc.).</p>	<p>-- A communication plan is essential to implement an effective strategy to increase the range of action, to focus on key sectors or audience groups. A regular review of this is necessary.</p> <p>-- There seemed to be an imbalance between how the on-line information about IAS is transmitted in Portugal and Spain. Also, an apparent greater interest about uses or usable taxa of IAS than about their impacts was observed.</p> <p>-- We found differences in IAS' percetion between countries, and between different stakeholder groups. The initial assessment also showed that the awareness of socioeconomic and human health impacts was substantially lower when compared with impacts on biodiversity. Thus, communication efforts were made to expose the negative effects of IAS on the communication plan.</p> <p>-- Establishing a communication section in the staff work-meetings to ensure a common adaptive strategic approach for the communication actions. The principles are the same but the techniques and approaches vary, depending on the information, the audience addressed or the entity that seeks to be replicated. The regular meetings have also served to reinforce the interaction between the partners or improve the flow of information on upcoming events.</p> <p>--To reach society, one of the best ways is journalistic information. In this sense, the importance of having specialised journalists and reference media is an added value. Moreover, key tools are the generation of information elaborated with journalistic criteria and language, plurality of sources and varied and attractive topics.</p> <p>--A useful tool to be used when disseminating is the creation of a database to identify certain actors of stakeholders and key groups of interest.</p>

A.2. Diagnosis of the situation & development of EWRR tools.

Tangible results	Lessons learned
<p>Capacity building, identify information and communication needs and formats.</p> <p>-- We developed a database with updated information of approx 467 alien taxa (8,500 records collected and 927 bibliographic references indexed). This was the initial version of the database that feeds the Invasive Alien Species web-platform (https://eei.sibic.org/).</p> <p>-A protocol to harmonise data of Iberian aquatic IAS for institutions to integrate data to European and Global data-bases was developed.</p> <p>Initial engagement and training to develop documentation, instruments and campaigns.</p> <p>--The informative guide <i>Watch Out! Aquatic Invaders</i> (Available in Spanish (ES), Portuguese (PT) and English (EN)), with 43 authors involved. In a divulgative approach, it includes 100 fact-sheets of Iberian aquatic IAS.</p> <p>--Training webinars addressed to the project staff (also to collaborators), among others, to implement a strategy and develop surveys (questionnaires), to develop a Citizen Science Program (IUCN), to engage members of the Society of Iberian Ichthyology (SIBIC), etc.</p> <p>-- Merchandising, flyers, general brochure in 6 languages, triptychs of the Project, promotional videos in ES and PT, etc.</p> <p>-- A collaborative process with more than 60 experts from Spain and Portugal has developed to establish updated inventories of aquatic IAS.</p> <p>Technical Report: LIST OF THE AQUATIC ALIEN SPECIES OF THE IBERIAN PENINSULA. Updated list of 306 introduced or established alien species in Iberian inland waters (Recorded Alien list). ES, PT, EN versions. (Oliva-Paterna et al. 2021a).</p> <p>Technical Report: LIST OF THE POTENTIAL AQUATIC ALIEN SPECIES OF THE IBERIAN PENINSULA. List of 272 potential alien species in Iberian inland waters (Potential Alien list). ES, PT, EN versions. (Oliva-Paterna et al. 2021b).</p> <p>Technical-Report: EICAT APPLICABILITY ON IBERIAN AQUATIC IAS - FIRST APPROACH.</p>	<p>-- A large number of scientists and experts of IAS management from Spain and Portugal contributed to the Project assessments, providing an example of the catalytic effect that the support of LIFE programs can have.</p> <p>-- Collaborative processes with experts are essential for the development of up-to-date technical-scientific material. However, coordination by project staff is necessary to achieve project milestones.</p> <p>-- The resulting updated lists and information were part of a wider initiative within the LIFE INVASAQUA project, which aimed to assess the status of the vast majority of Iberian aquatic alien species. By compiling information on populations, ecology, habitats and recommended management measures for several aquatic IAS, this initiative will provide key resources for decision-makers, environmental managers, NGOs, and other stakeholders in implementing actions. The outputs of this initiative can be applied to inform policy, and to identify priority IAS to be included in monitoring and research programmes, as well as to identify priority areas for management plans. However, updated inventories are dynamic tools that will evolve with time according to new information or situations. They will also aim at stimulating and supporting research, monitoring, and management actions, mainly in prevention measures, at local, regional and trans-national levels.</p> <p>-- EICAT methodology developed by IUCN can become a good tool for regional management, mainly from the point of view of prevention and evaluation at EU member states level.</p> <p>-- High visibility obtained to the Project in events to launch the Technical Reports; results were presented through different communications in workshops with decision-makers and other stakeholders.</p>

B. CORE ACTIONS

B.1. Communication and Information Campaign to decision-makers public administration, scientific community and NGOs	
Tangible results	Lessons learned
<p>Campaign for decision-makers, NGOs and scientific community.</p> <ul style="list-style-type: none"> -- Invasive Alien Species Web-platform (https://eei.sibic.org/) with a base-data of more than 200 taxa of established IAS. Currently, more than 20,000 records. This web is linked to the official LIFE INVASAQUA web and the IBERMIS platform. In addition, SIBIC has been included as EASIN datapartner. -- Co-organised of Congress and Conferences. An example is the Iberian Congress on Invasive Alien Species held in Pamplona in April 2022 (EEI 2022 Congress). It has also organised special sessions and workshops at different international Iberian conferences (Restaurarios 2019, SIBIC2020, AIL2020, SIBIC2022 and Restaurarios 2023). -- Workshops and Forums of knowledge transfer events involving management stakeholders (e.g. Forums of Knowledge transfer in the National Museum of Natural History, Madrid). -- Participation in 36 congress and/or special workshops addressed to manager groups. -- Work-meetings and training of EICAT applicability. -- Collaborative process with experts to develop the horizon scan assessment (Oficialdegui et al. 2023). -- On-line training course (in MOOC format) to key stakeholders. <p>Technical Report: TRANSNATIONAL HORIZON SCANNING FOR THE AQUATIC INVASIVE ALIEN SPECIES OF THE IBERIAN PENINSULA – BLACK AND ALERT FINAL LISTS. A final concern List included and prioritised 127 introduced aquatic IAS and a final Alert List included and prioritised 89 potential taxa not yet present in Iberian inland waters were included (Oliva-Paterna et al. 2022).</p> <p>Development comprehensive strategies for the management aquatic IAS. A participatory process involving management stakeholders and groups of external experts to develop transnational recommendations for the management of top taxagroups of aquatic IAS.</p> <p>Technical Report: STRATEGIC RECOMMENDATIONS FOR THE TRANSNATIONAL MANAGEMENT OF INVASIVE ALIEN FISH IN IBERIAN INLAND WATERS.</p> <p>Technical Report: STRATEGIC RECOMMENDATIONS FOR THE TRANSNATIONAL MANAGEMENT OF INVASIVE CRAYFISH AND CRABS IN IBERIAN INLAND WATERS.</p>	<ul style="list-style-type: none"> --The Project web platforms could be serving as models for other biodiversity or IAS platforms being key instruments for policy making actions. --Some conclusion of workshops, work-meetings and forums: <ol style="list-style-type: none"> (1) Even with a high number of prevention and control experiences of aquatic IAS at the Iberian level, more coordination between scientists, surveillance agents, and decision-makers is necessary for a more effective management of IAS. (2) LIFE and EU project presentations in networking events make it possible to put in touch different groups in the audience (Public Administration, environment and education professionals, and journalists) with common interest in IAS. (3) Knowledge transfer events have proved to be a good source of visibility of the project and also to involve stakeholders in the action. These events provide discussion spaces and they are key instruments to enhance synergies, identify further needs on the IAS topic and keep the interest of policy makers. We believe that these events will help to support the EU Regulation implementation on IAS by engaging and creating synergies between knowledge building and management. (4) At the Knowledge Transfer Forums, attendees agreed on the need to increase information on the problem, improve awareness and dissemination of information on IAS, and create networks and synergies between entities and groups involved in their management. Similarly, the focus was placed on research on a local scale, to bring the problem closer to accessible and comprehensible scales, and on the need to increase prevention efforts. All of this will facilitate an improvement in the management of IAS, reducing the cost of the impacts derived and being able to focus on species that are still in time to be eradicated. -- The composition of panels of experts is essential to prioritise criteria and selection of scientific information. The collaborative process (workshops, meetings, surveys to evaluate documentation, etc) is highly recommended.

B.2. Trans-iberian Communication, Information and Training campaign to key target stakeholders

Tangible results	Lessons learned
<ul style="list-style-type: none"> -- Campaigns with specific materials to key groups developed by the Project were organized. -- 98 training events have been carried out, with the direct participation of more than 2,900 people. -- Publications in journals, blogs, conferences, etc. A total of 725 communications were developed by the Project staff and external collaborators (including publications under the Action B.3.). -- Participation in 31 congresses and/or workshops addressed to key groups. -- Online awareness-raising surveys (questionnaires). The total number of responded surveys obtained was 7078 (including surveys under the Actions A.1. and B.3.). -- Codes of conduct & best practices that promote recommendations to reduce the problem of IAS in different contexts and performed also to be used in training courses. A total of 9 different codes were developed. -- The information guide entitled <i>Watch out! Aquatic Invaders</i> (also under the Actions A.1.). -- The <i>Review-Clean-Dry</i> materials for the river and estuary users (described in A.1.). -- On-line free courses in MOOC format. These courses were tutored by experts, had a high level of discussion and participation between the Invasaqua trainers and students. -- 57 <i>Youth Engaging Events</i> at universities and schools. Among them, the Iberian Youth Conference in Benavente (Portugal) and the StudIAS 2022 Congress in Pamplona (Spain). -- 76 Field work projects on IAS with universities and high schools to engage students. -- 32 University student grade or master projects. -- Pedagogical materials and school teacher training courses. A <i>didactic notebook</i> has also been published in Portuguese and Spanish. -- 27 Events with NGOs and River & Estuary users. 	<ul style="list-style-type: none"> -- Participation in congresses and workshops (from local events to international conferences) is essential to transfer the results of projects, enhance networking, identify further needs on the IAS topic and keep the interest of key stakeholders. -- Preliminar information from awareness-raising surveys was useful for the Project team to focus activities, events and materials developed by the Project. -- On-line short and simple surveys (questionnaires) are sometimes the way to obtain empirical information. Survey implementation through the internet has several benefits, namely low costs and easy implementation, but also does not present high bias if compared with traditional methods such as mail, telephone or in-person interview. However, not all people have access to this possibility and groups, for example, such as young students need hard-paper versions. -- Co-production of materials involving the key target group in the revision of the contents as we did for codes of conduct was a fruitful experience promoting stakeholders participation and increasing content quality and usability of the documents. For example, E-commerce code of conduct was supported by more than 60 entities through the campaign "Stop IAS Commerce". So, processes involving stakeholders in evaluating and complementing documents and materials are essential to involve the target sector and ensure quality and usability of the materials. -- Specific for the campaign Stop IAS Commerce to promote the code of conduct through specific campaigns targeting the stakeholder (suppliers and consumers of exotic species) was an efficient way to disseminate its contents and involve different entities interested in the topic. -- Events and activities with stakeholders and the general public are the appropriate spaces to increase the dissemination of documents and materials generated by the Project, as well as to give visibility to other actions developed. -- The educational sector, especially students, is made up of people with a high receptive capacity, although the message on IAS issues must be targeted and delivered in an adapted language. Primary students predominantly present a social view of the issue, while Secondary students highlight ecological impacts.

B.3. Trans-Iberian Information and Communication campaign to general public (citizens).

Tangible results	Lessons learned
<p>Publications and news -- Publications in journals, blogs, conferences, etc. A total of 725 publications and communications were developed by the Project team and external collaborators (including publications under the Action B.2. of the Project).</p> <p>Communication campaign through media -- More than 160 materials, including interviews in podcast, informative videos, animation videos, multimedia reports, etc. (2,123 registered web-views of the Official video of the Project; 45,433 views of the Multimedia reports; and 2,245 views of the Animation videos). -- Training seminars on IAS for Media. -- A total subscribers (total of 1916 persons) to the newsletter developed regularly by the Project (6,928 total views). -- The STOP IAS Commerce campaign and materials for general public. -- Mass raise-awareness campaigns by social networks. A total of 11,780 followers on social networks (5,832 Twitter-X - 1,168 Facebook - 3700 LinkedIn - 1089 Instagram) (date 01/October/2023). --The official Project website has registered a total of 120,727 users and a total of 574,727 visits (244,758 number of unique visits) (date 01/October/2023), -- The itinerant museum exhibition <i>Watch out! Aquatic invaders</i>, displayed in more than 20 different locations in Spain and Portugal (more than 150,000 visitors in a conservative estimate) and replicated by Public Administrations. -- Participation in awareness events under Global Initiatives (massive events) such as the Science and Technology Week or the World Rivers Day. -- Co-organised of three editions of <i>the Invasive Species Week in Portugal & Spain (SEI)</i> (in 2023 has involved 250 entities and more than 2,800 participants).</p>	<p>- The communication plan created in the initial phase of the project has been fundamental to guide the communicative actions of the project. This plan can be replicated and transferred to other projects focused on communication and knowledge management. In this sense, the participation of experts and communication professionals in information projects is necessary, at least in the initial stages.</p> <p>-- It is necessary to work on the communication message in order to focus it specifically on the sectors to be reached. Therefore, the use of a wide range of tools makes it possible to increase the field of action and facilitates the participation of key groups.</p> <p>-- Communication in different ways (Press releases, Non-scientific publications, Radio slots, Publications in national or regional press, etc.) has been essential to raise awareness and interest in society. Updated knowledge can be transferred during and after the end of the project to the media and this approach can be replicated by other IAS starting projects.</p> <p>-- The social-networks have been very useful to increase the channels of communication and dissemination among different profiles and social sectors.</p> <p>-- The official web platform of the Project, as a tool to the communication of news and multimedia materials, has also been an essential instrument for the visibility of the project and for the raise-awareness campaigns. Concentrar toda la información generada por el proyecto en una única plataforma web facilita la interconexión de los materiales y recursos; aumentando las posibilidades de que diferentes sectores puedan acceder a una amplia gama de información.</p> <p>-- The production of different types of content and material on the impact of aquatic IAS has proved successful in raising awareness and encouraging society to take action to prevent their deliberate or accidental spread. It is necessary to focus on the socio-economic and health problems of the IAS.</p>

B.4. Awareness and engaging people in collecting IAS Data.

Tangible results	Lessons learned
<p>Tools for engaging citizen</p> <p>-- The IBERMIS web platform (only two years old and has already accumulated a total of 2363 users). The project has supported the European Commission's approach to centralising information by linking this platform to the European Alien Species Information Network (EASIN).</p> <p>-- The <i>Iberian module of the App</i> - IAS in Europe. A citizen science tool to involve the public in monitoring invasive species. This module was developed under the collaboration the Journal Researc Center (JRC) and the staff of EASIN, and collaborators from the University of Castilla-La Mancha.</p> <p>Awareness and Engaging campaign (Voluntary networks)</p> <p>-- Campaing to promote the use of the App – IAS in Europe has allowed the implementation of various formats (bioblitz-type events, environmental volunteering with NGOs, fishing competitions, etc.) through which a significant increase in knowledge and awareness of the participants has been achieved.</p>	<p>-- The IBERMIS web platform brings together different databases to visualise data. It is a hub of open IAS sources. It hosts training courses for different stakeholders whose structure can be replicated and used in additional training. The multifunction platform can serve as a model for new emerging projects on IAS.</p> <p>-- The use of the previously existing App - IAS in Europe for the development of a regional module and its integration with other databases developed by the project (including web-based viewers) has proved very useful for harmonising information and providing long-term usability.</p> <p>--The regional catalogue experience from de App has been tested in different parts of Europe and the Iberian module has been the most used so far. The module can be maintained and serve as a model for other regional catalogues in Europe, including the engaging activities implemented to train de App (bioblitzes, volunteering, contest, etc.).</p> <p>-- A good lesson learned is that it is very relevant to have a project approach to capitalise on existing knowledge, materials, resources, etc. An example is what has been done with the EASIN App and its improvement with the Iberian module. Indeed, it is necessary to collaborate with those who are already working or have already worked on the topic in question, in order to use their resources, knowledge and resources and knowledge and to make the most of them, with a focus on improving.</p> <p>-- Engaging events or citizen science events in collaboration with other entities are useful to involve them and are an effective way to raise awareness of IAS.</p>

C. REPLICABILITY AND TRANSFERIBILITY ACTIONS

C.1. Replicability and transferability: dissemination of the results and lessons learned.	
Tangible results	Lessons learned
<p>Networking and discussions spaces with other projects (Congress and Conferences)</p> <ul style="list-style-type: none"> -- Co-organization of congress and special sessions on IAS in conferences. -- The Project has co-organised the <i>VI National Congress and Iberian Congress on Invasive Alien Species</i> (EEI 2022) held in Pamplona, April 2022. -- The Project has organised special sessions and workshops in the Iberian on IAS in different Iberian congresses (RestauraRios Congresses 2019 and 2023, Ichthyology Congresses SIBIC-2020 and SIBIC-2022, Limnology Congress AIL-2020). --The project has granted scholarships to more than 40 students and young researchers to facilitate their participation in several Iberian congresses and conferences. -- International networking events were organised with the presence of European projects and entities related to the IAS: (1) <i>“Exchanging Experiences on IAS Projects in Europe: Lessons Learned”</i> (Málaga, May 2023); and (2) <i>“Addressing IAS in Europe: The relevance of transnational cooperation and the stakeholder engagement”</i> (Brussels, September 2023). <p>Transferability and Replicability Plan (IUCN & UMU, 2023)</p> <ul style="list-style-type: none"> -- The Plan identifies key elements of the Project that have potential for transfer or replication that may include technologies, methodological approaches, best practices or collaboration models, among others. In addition, also includes applicable recommendations. 	<ul style="list-style-type: none"> -- Congresses and conferences are important spaces to transfer the results of projects, enhance networking, identify further needs on the IAS topic and keep the interest of key stakeholders related to management. --Transnational co-organization of congress and conferences is a highly enriching collaboration that can be replicated by other bordering countries and shared river basins involving different stakeholders and the public. -- There seemed to be an imbalance between how the on-line information about IAS is transmitted in Portugal and Spain. Also, an apparent greater interest about uses or usable taxa of IAS than about their impacts was observed. -- International networking events are very positive in facilitating the exchange of knowledge and lessons learned between projects and participants, reinforcing cooperation. During the event, participants expressed that holding such events is very important between LIFE projects to generate knowledge transfer and increase impact, expressing, for instance, the need to consider funding LIFE projects even after they have finished in order to give continuity to specific actions that have proven to be effective. Some short lessons learned from 27 EU projects regarding IAS obtained from the networking events were detailed in the <i>Transferability and Replicability Plan</i> (see IUCN & UMU, 2023). -- Environmental volunteering as an action of involvement in an environmental problem such as IAS is a good tool to involve society in taking responsibility. Volunteering has also proved to be a tool for emotional and social connection with the environment and other people, and social connection with the environment and other people and organisations concerned about the same issue.



LIFE **INVASA**QUA

Abstract

The Spanish and Portuguese societies have a limited understanding of the threats posed by invasive alien species (IAS) in aquatic ecosystems. This gap of knowledge and awareness about IAS problems hampers any policy proposed by administrations and stakeholders, contributing to missing an IAS management strategy. We present the actions, main results and some learned lessons achieved in the Environmental Governance and Information LIFE project—LIFE INVASAQUA—that will run between 2018 and 2023 in the Iberian Peninsula.

The main goal of INVASQUA was to increase the Iberian public and stakeholders' awareness of aquatic IAS problems and to develop instruments and tools that will improve an efficient management and Early Warning and Rapid Response frameworks for IAS in freshwater and estuarine ecosystems. This Technical Report focus on tangible results, key-instruments and outcomes of the project to explore some of the problems and lessons encountered in the implementation.

WHAT IS LIFE INVASAQUA?

A European project that seeks to tackle aquatic invasive alien species in Spain and Portugal by increasing public and stakeholder awareness. It will contribute to improve IAS management and reduce their environmental, societal, economic and health impacts through information campaigns and the exchange of successful management solutions and practices.

HOW WILL IT BE ACHIEVED?

Creating priority lists of IAS and strategic management guidelines at the Iberian level to support and facilitate the implementation of the EU Regulation. Implementing training and information campaigns with key stakeholders. Developing communication and awareness activities through volunteering campaigns, citizen science, events with students or travelling exhibits across the Iberian Peninsula.

Coordination:



www.lifeinvasaqua.com

life_invasaqua@um.es



Associated beneficiaries:



With the support of:



LIFE17 GIE/ES/000515 Co-funded by the European Commission under the LIFE Program