# LIST OF AQUATIC ALIEN SPECIES OF THE IBERIAN PENINSULA (2020)

Updated list of aquatic alien species introduced and established in Iberian inland waters

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Red-eared slider (*Trachemys scripta*) © Javier Murcia Requena

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**LIFE INVASAQUA – TECHNICAL REPORT**

Pumpkinseed (*Lepomis gibbosus*) © Bernard Dupont.. CC-BY-SA-2.0

**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 by the European Project LIFE INVASAQUA (LIFE17 GIE/ES/000515). It has been drafted by a team of experts within the framework of the Project and aims to provide evidence-based scientific support to the European policy-making process. The scientific output expressed does 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.

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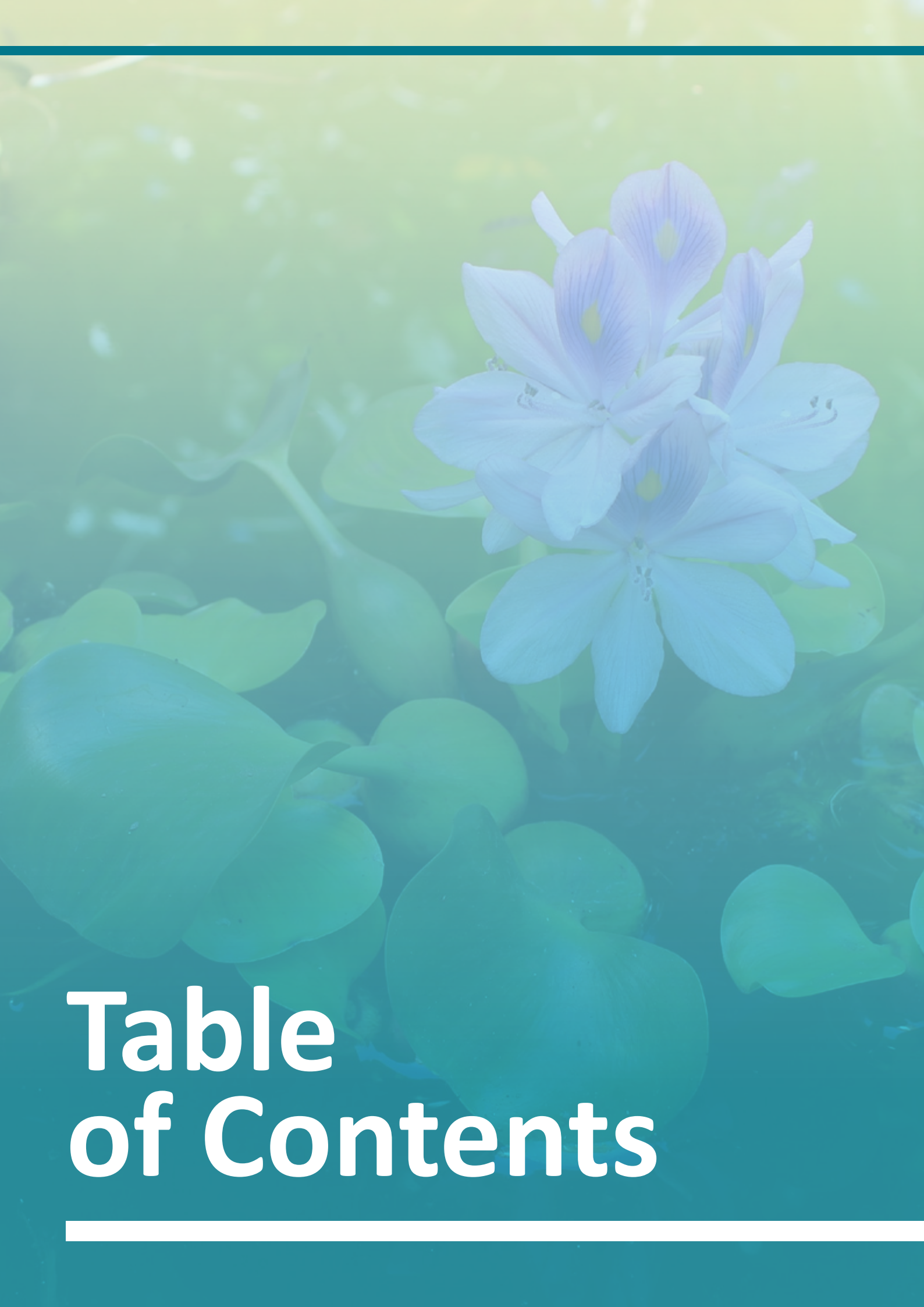
**Abstract:**
An updated list is presented of the alien species in the establishment or spread invasion stage in inland waters at the Iberian Peninsula. The list is based on a systematic assessment of information in collaboration with a wide expert team from Spain and Portugal. This updated list is an important tool supporting the implementation of the IAS Regulation and provides 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.

Comments which could support improvement of this document are welcome. Please send your comments by e-mail to life_invasaqua@um.es or fjoliva@um.es.



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# Foreword

Spyridon Flevaris
EU Commission

Alien species are typically defined as species introduced outside their natural range by human-mediation, intentionally or unintentionally. Such introduction is the first step of the invasion process: some alien species will establish in their new environment with adverse impacts on biodiversity. These are termed as invasive alien species and are one of the five major causes of biodiversity loss. Recent research has demonstrated that globally there is an increasing and accelerating trend of new introductions of alien species and subsequently of the numbers of potential invasive alien species.

National and European Union legislation has been adopted in an effort to address the problem of invasive alien species and since 1992, the LIFE programme has been the main source of EU funding for actions aimed at addressing the threats from invasive alien species. There is general agreement that the prevention of the establishment is generally more environmentally desirable and cost-effective than measures taken after the introduction and establishment of invasive alien species. The identification of alien species (already introduced in a territory or not) that have a potential to become invasive provides the basis for preventive measures and prioritised management action.

The project LIFE INVASQUA makes a significant contribution in this direction by publishing updated lists of ***the aquatic alien species introduced and established in Iberian inland waters*** and of ***the potential aquatic alien species with high risk of invasion in Iberian inland waters***. These lists can inform the further development of early detection and rapid eradication structures in Portugal and Spain. They can also serve as tools for understanding and managing the pathways of introduction of alien species into freshwater and estuarine systems as well as for communicating the size of the problem to all related authorities and stakeholders.

A large number of scientists, managers and experts from Competent Authorities and NGOs from Portugal and Spain have contributed to the compilation of these lists, providing an example of the catalytic effect that the financial support from LIFE programme can have. The dynamic nature of biological invasions require however that such lists are regularly updated in the future.

Spyridon Flevaris
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1 The information and views set out in this foreword are those of the author and do not necessarily reflect the official opinion of the European Commission.

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## Contributors

Several regional and national competent authorities and some scientist supported the compilation by providing inventories on alien species (see List of contributors). SIBIC coordinated a pre-assessment providing a great pool of data coming from the CPE (http://www.cartapiscicola.es/). LIFE INVASAQUA and SIBIC developed a website and data portal of records of the taxa included in the present list (https://eei.sibic.org/). Coordination members and beneficiaries of the LIFE INVASAQUA contributed by facilitating logistics in some of the workshops.

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Water hyacinth (*Eichhornia crassipes*). Jero Morales © EFE

# Acronyms and short-names

**AIL –** Iberian Society of Limnology

**CIREF –** Iberian Centre of Fluvial Restoration

**EASIN –** European Alien Species Information Network

**EU –** European Union

**EWRR –** Early Warning and Rapid Response framework

**IAS –** Invasive Alien Species

**IAS Regulation –** 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

**IUCN –** International Union for Conservation of Nature

**MS –** Member State of the European Union

**Portuguese National List of IAS –** The National List of Invasive Species (Annex II, Decreto-Lei 92/2019).

**SEF –** Spanish Society of Ficology

**SEM –** Spanish Society of Malacology

**SEO/BirdLife –** Spanish Society of Ornitology

**SIBECOL –** The Iberian Society of Ecology

**SIBIC –** Iberian Society of Ichthyology

**Spanish Allochthonous List –** List of non-native species capable of competing with native wild species, altering their genetic purity or ecological balances (related to R.D. 570/2020).

**Spanish IAS catalog –** The Spanish Catalog of Invasive Alien Species (Annex, R.D. 630/2013).

**SPEA/BirdLife –** Portuguese Society for the Study of Birds

**Water Framework Directive –** Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy.

# Executive Summary


## Aim

Invasive Alien Species (IAS) are a major direct driver of biodiversity loss and ecosystems service changes and constitutes one of the greatest threat to fragile ecosystems such as estuarine and inland waters.

LIFE INVASAQUA European Project aims to reduce the introduction and spread of aquatic IAS, among others, by developing tools that will improve the management and Early Warning and Rapid Response (EWRR) framework for IAS in the Iberian Peninsula.

The List of the Aquatic Alien Species of the Iberian Peninsula (hereafter referred to as List) is an updated inventory of the alien species that are in the spread stage or establishment stage of the invasion process into the inland waters at the Iberian level.

## Scope

The listed alien aquatic biota was divided into five main groups: vertebrates, invertebrates, plants, macroalgae and fungi (micro-organisms were not included). The main objective was to update a checklist by systematically listing the alien species already recorded in inland waters to assess the invasion stage and thus define their status (i.e. established, uncertain or cryptogenic).

The geographical scope encompassess the Iberian Peninsula. Neither the inland water habitats of the Balearic Islands nor Macaronesia islands belonging to Portugal and Spain are included.

## Assessment

LIFE INVASAQUA Project coordinated and supported a participatory method with a group of 60 experts to identify issues, agree on methodologies and progress by consensus. The assessment was compiled based on data and knowledge from that group who represented a large biological invasions expertise in different taxa and bioma types 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, three workshops and several web-meetings were held from January 2019 to October 2020.

The outcoming List is a product of scientific consensus concerning species invasion status and is supported by relevant literature and data sources.

## Results

A total of 306 alien species were identified as introduced or established (naturalised) in Iberian inland waters, several of which exhibit invasive behaviour and have a high impact on aquatic ecosystem services and biodiversity.

Summing up, this updated List summarises results for 200 alien aquatic taxa clearly established or naturalised in the estuarine, freshwater and hypersaline aquatic systems of the Iberian Peninsula (Appendix A), and another 106 introduced taxa which have been defined as uncertain status (Appendix B).

Chordata (27.4% of the total), followed by Arthropoda (21.9%), Mollusca (13.4%), and Magnoliophyta (10.5%) are the most listed taxa. The four groups represent 73.5% of the established taxa (Appendix C).

## Key conclusions

The resulting List is an important tool supporting the implementation of the IAS Regulation, and provides a factual basis for the review of its application.

This commonly acknowledged List will help Spain and Portugal in the establishment of a surveillance system of the key alien species and can foster trans-national cooperation and coordination across borders or within shared biogeographical regions. This updated and shared information of IAS will also help Spain and Portugal, and the EU, in monitoring the variation of the IAS trends in Europe and the effectiveness of the actions undertaken by the competent authorities by implementing the IAS Regulation.

Ultimately, the List provides valuable information to the implementation of other EU policies related with alien species, such as the Birds and Habitats Directives and the Marine Strategy and Water Framework Directives.

LIFE INVASAQUA Project has proved to be a good source of information of IAS within Spain and Portugal supporting the EU Regulation implementation on IAS by engaging and creating synergies between knowledge building, management decision-makers and stakeholders. In this sense, competent Spanish and Portuguese authorities for implementing the IAS Regulation and several academic societies will be invited to check and validate the List presented here.

American signal crayfish (*Pacifastacus leniusculus*) © José M. Zamora-Marín

# 1 Introduction and aims

# 1. Introduction and aims

## 1.1. Background

Biological invasions are one of the major drivers of global change that can negatively affect biodiversity, ecosystem functions and services, and human health (EEA 2012, Ricciardi et al. 2013, Simberloff et al. 2013, Early et al. 2016, IPBES 2019, Pyšek et al. 2020). Efficient mitigation of this important driver requires the improvement of public and stakeholder awaresness, and policy regarding its significant impacts on our socio-ecosystems (Laverty et al. 2015, Diagne et al. 2020).

Alien species introduction, as defined in the EU Regulation 1143/2014 (hereafter referred to as the IAS Regulation), constitutes a major threat to aquatic environments (Flood et al. 2020). Compared to terrestrial systems, estuarine and inland waters are highly vulnerable to either inadvertent or deliberate introductions of taxa and to the consequences of their spread (Dudgeon et al. 2006, Gherardi 2007). These alien species can be invasive in their new environment, causing biodiversity loss and alterations to ecosystem structure, functions, and service which may result in socio-economic impacts (Villamagna & Murphy 2010, Vilà et al. 2011, Jeschke et al. 2014, Tsiamis et al. 2020). Their threat is growing as the number of established alien species have increased in different taxonomic groups and in many countries around the world  with no sign of saturation (Seebens et al. 2017, 2020).

Recent studies consider almost 20,000 alien species in the world (Pyšek et al. 2020). Current availability of global data on alien species and their distribution have improved, and there is almost a complete knowledge of the number of IAS for several taxonomic groups. The European Alien Species Information Network (EASIN), formally recognised as the information system supporting European Member States (MS) in the implementation of the IAS Regulation, recorded almost 14,000 alien species in European ecosystems. Several of them exhibit invasive behaviour and have a high impact on ecosystem services and biodiversity causing adverse effects on environmental quality and irreversible economic losses (Katsanevakis et al. 2012, 2015). In fact, a conservative estimate, IAS cost the European MS €12 billion in damages annually (Kettunen et al. 2009), but accumulated costs probably reach €20 billion per year (Tsiamis et al. 2017). In addition, there is an increasing trend towards the introduction of new IAS, with the vast majority being introduced unintentionally (Essl et al. 2015, Roques et al. 2016) and a particularly significant trend in aquatic environments of southwestern Europe (García-Berthou et al. 2007, Cobo et al. 2010, Maceda-Veiga et al. 2013, Nunes et al. 2015, Anastácio et al. 2019, Muñoz-Mas & García-Berthou 2020). For instance, since the 1970s, Portugal increased the number of successful introductions in inland waters to an approximate rate of 14 new species per decade (Anastácio et al. 2019). According to recent studies of projecting the continental accumulation of alien species in 2050, Europe showed the highest increase in the prediction of new established alien species (Seebens et al. 2020).

Recognising the need for a coordinated set of actions to prevent, control and mitigate IAS, the European Parliament and Council have adopted the EU Regulation 1143/2014. This regulation on invasive species sets out rules to effectively tackle the problems linked to IAS, seeking to prevent the entry of IAS, 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 (Genovesi et al. 2015, Reaser et al. 2020). In this management framework, updating a checklist of taxa already established or naturalised in any MS of the EU (also in any biogeographical area), as well as other information such as taxonomic groups, region of origin, year of introduction or pathways is essential to design proficient prevention protocols, to promote unequivocal prompt detection and rapid response, and to adjust current legislation (Bertolino et al. 2020, Wallace et al. 2020).

The List of the Aquatic Alien Species of the Iberian Peninsula (hereafter referred to as List) presented here is an updated inventory of the alien species in the establishment or spread invasion stage in inland waters at the Iberian level. Under the IAS Regulation, Spain and Portugal must prevent the alien species to be introduced and spread, enforce effective EWRR mechanisms for new introductions, and adopt management measures for those that are already widely spread. The List of established and introduced alien species defined in the present technical report should be a key tool for improving IAS prevention and management.

Ultimately, the information included in the present technical report can also 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, the Marine Strategy Framework Directive, and the Water Framework Directive.

## 1.2. Objectives of the List and purpose of the report

The List has three main objetives:

- To update previous information on the topic by sistematically listing the alien species introduced (establishment stage) with uncertain status and/or already established or naturalised (spread stage) in Iberian inland waters.

- To contribute to regional, national, and European IAS management and control plannings through provision of a baseline updated list which can provide valuable information, for instance, in monitoring the IAS trends in Europe.

- To constitute a reference tool for the decision-makers and stakeholders, in addition to facilitate channels of communication, transfer and discussion between key groups involved in environmental management.

The assessment developed and the resulting List provide the next main outputs:

- A summary report on the updated checklist of all aquatic alien species recorded in the Iberian Peninsula with their invasion status (established, uncertain, cryptogenic) by expert consensus.

- A freely available database holding the descriptive data for all aquatic alien species defined in the establishment and spread invasion phase.

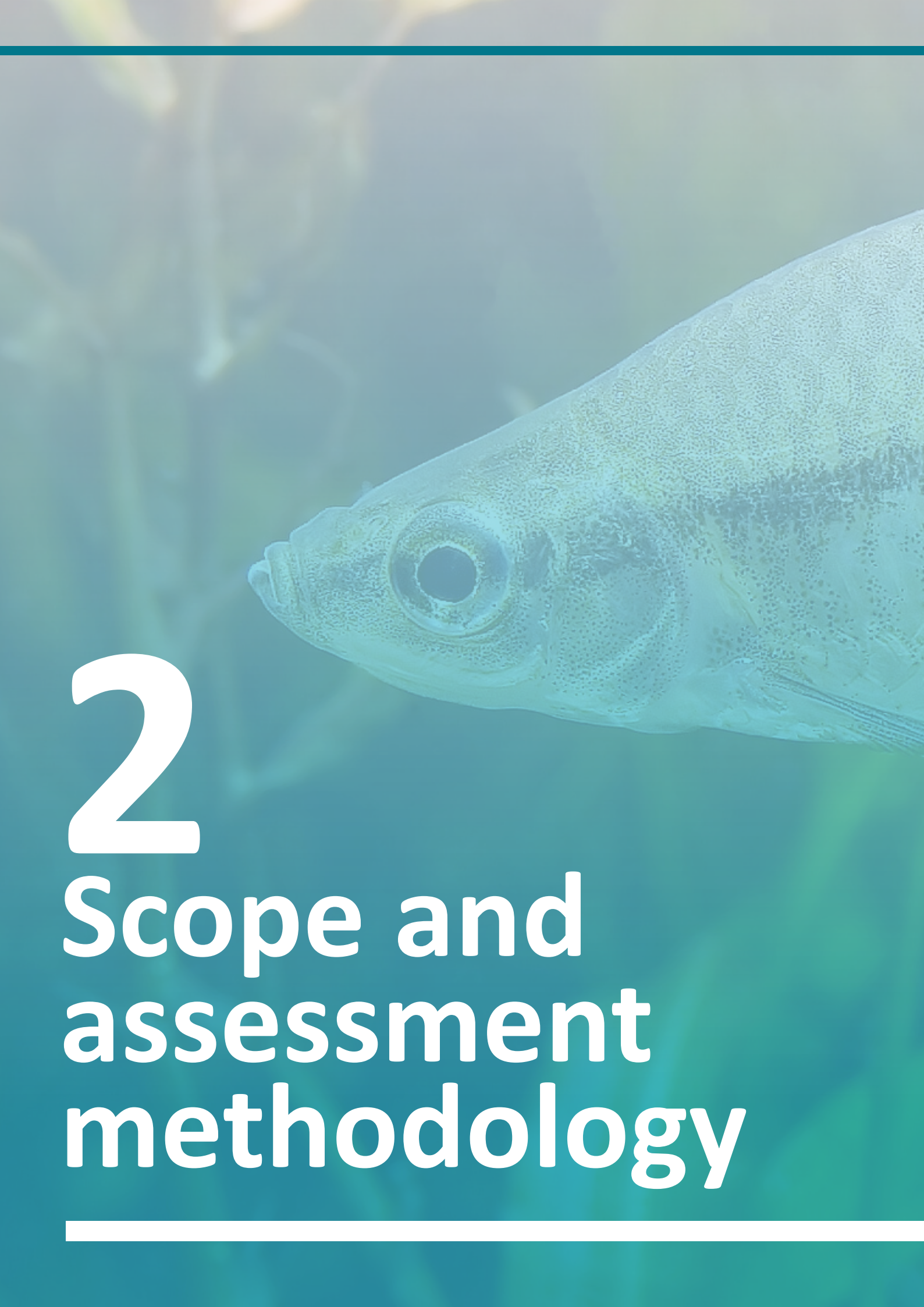
- At the same time, LIFE INVASAQUA and SIBIC have developed a website and data portal of records showcasting information in the form of factsheets of most of the taxa included in the present list (https://eei.sibic.org/).

The List presented in this technical report provides a snapshot of the information available at the time of writting, and LIFE INVASAQUA will generate updated versions of it. In a later stage, competent Spanish and Portuguese authorities for implementing the IAS Regulation and several Academic Societies (e.g. SIBIC, AIL, CIREF, SEF, SEM, SEO/BirdLife, SPEA/BirdLife, SIBECOL, etc.) will be invited to check and validate the List. This way, any error and omission may be addressed.

In addition, in order to prioritise the most threatening and emerging IAS in the Iberian Peninsula, a new approach is required to support future updates of the present List. In this context, horizon-scanning is essential to prioritise the threat posed by established taxa and by potential new IAS not yet established within the Iberian Peninsula.

Finally, it should be noted that the aim of LIFE INVASAQUA, and thus its technical reports, is to promote collaboration and coordination with decision-makers and ensure data sharing and exchange.

Blue crab (*Callinectes sapidus*) © DCChefAnna. CC BY-NC



# 2 Scope and assessment methodology

# 2. Scope and assessment methodology

## 2.1. Geographic scope

The geographical scope encompasses the Iberian Peninsula. Neither the estuarine and inland waters of the Balearic Islands nor Macaronesia islands belonging to Portugal and Spain (Canary Islands, Madeira and the Azores) are included. Therefore, the List assessment was for the continental areas of two EU member states, Spain and Portugal.

## 2.2. Alien aquatic biota scope

The Refence List followed the definition of **alien species** according to IAS Regulation (EU Regulation 1143/2014) (BOX 1) including species moved by human activities beyond the limits of their native geographic range into the Iberian Peninsula in which these do not naturally occur. Transport allowed these species to overcome fundamental biogeographic barriers to their natural dispersal. Common synonyms for alien species are: exotic, introduced, non-indigenous, or non-native (Blackburn et al. 2011). Most of them may be considered as **invasive alien species** (BOX 1) because they are causing important negative ecological and socio-economic impacts in Iberian aquatic systems or because they may potentially incur in these impacts. In addition, and by definition, any alien taxon in a new environment has a non-zero impact according to the International Union for Conservation of Nature (IUCN 2020).

The experts involved in the assessment have analysed the establishment and spread stage in the Iberian Peninsula of the alien aquatic biota which includes alien organisms living in or depending on the aquatic environment at least during a part of their life-cycles (BOX 1). Inland waters are aquatic-influenced environments located within land boundaries. This includes those located in coastal areas, even if adjacent to marine environments, and they involve most of the aquatic habitats included in the **transitional waters** and **inland waters** defined in the EU Water Framework Directive (BOX 1). We understand the target aquatic habitats as the following: (a) streams and rivers; (b) lakes, wetlands and reservoirs; (c) marshlands and brackish waters; (d) ponds and pools.

The listed alien species were divided into five main groups: vertebrates, invertebrates (free-living and symbionts), plants, macroalgae and fungi. Vertebrates include aquatic and semi-aquatic organisms, a few semi-aquatic invertebrates are also incorporated, and plants include submerged, floating and emergent aquatic plants which are mainly hydrophytes and helophytes. However, more detailed taxonomic groups (Phylum, Class, Order and Family) were also specified (see Supplementary material). The native range was divided into Europe, Africa, Asia-temperate, Asia-tropical, Australasia, Pacific, North America and South America. Whenever a native distribution included more than one region (e.g. Europa, Asia-temperate and Asia-tropical), all regions were considered. A few symbiont alien invertebrates (in many cases, parasites) associated to alien animal species have been included. Marine taxa (except those which commonly colonise estuarine or brackish waters) were not included in the assessment. All translocated species which are considered native in any part of the Iberian Peninsula (e.g. Iberian native species introduced between basins) were excluded from the assessment.

A unified framework for biological invasions recognises that the human-mediated invasion process can be divided into a series of stages (Blackburn et al. 2011). Furthermore, the stages of a biological invasion are linked to management actions that can be applied at different points of that invasion process (IUCN 2018, Kocovsky et al. 2018). For the species inclusion in the present List, the experts have assessed the invasion stage of each recorded alien taxa at the Iberian geographical scale as in **spread stage** or **establishment stage** (BOX 1). This definition is not an easy task, since species are dynamic within the invasion framework and are expected to cross barriers, transit between stages, and/or simply fail to do either. Moreover, an alien species could also have several populations on different stages. Therefore, reference to the invasion status on an Iberian level regarding certain given species should be temporally and spatially explicit. Potential taxa that are not present in the natural environments are excluded (transport and introduction stages *sensu* Blackburn et al. 2011).

Hence, the List primarily defines a group of species (status = **established**) introduced in inland waters where they already have wild and self-sustaining populations (Richardson et al. 2010, Blackburn et al. 2011). The second group included casual or introduced species (status = **uncertain**) that have been recorded in the Iberian Peninsula but are not clearly established or naturalised. Even if successful reproduction of some of these species may have been observed, their populations are not self-sustaining. Under expert consensus, this second group also includes dubious introductions of taxa catalogued as **cryptogenic**. These are species with unknown biogeographical history which cannot be ascribed as being native or alien in a location (IUCN 2020) and also species of contested origin (BOX 1).

### BOX 1 – Glossary of Key Definitions

**Alien Species:** are any live specimen of a species, subspecies or lower taxon of animals, plants, fungi or microorganisms introduced outside its natural range; it includes any part, gametes, seeds, eggs or propagules of such species, as well as any hybrids, varieties or breeds that might survive and subsequently reproduce (EU Regulation 1143/2014).

**Invasive Alien Species (IAS):** are alien species whose introduction or spread has been found to threaten or adversely impact upon biodiversity and related ecosystem services (EU Regulation 1143/2014).

**Alien aquatic biota:** is a collective term describing the exotic organisms living in or depending on the aquatic environment at least during a part of its life-cycle (expert consensus).

**Inland water:** means all standing or flowing water on the surface of the land, and all groundwater on the landward side of the baseline from which the breadth of territorial waters is measured (EU Water Framework Directive). In the present assessment, artificial water bodies such as reservoirs are included.

**Transitional waters:** are bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters, but which are substantially influenced by freshwater flows (EU Water Framework Directive).

**Spread stage:** in the invasion process includes taxa clearly introduced in the wild which are already naturalised and established, i.e. “species with self-sustaining populations in the wild” (Richardson et al. 2010, Blackburn et al. 2011). The concept involves established, naturalised or widespread invasive species.

**Establishment stage:** in the invasion process includes taxa that have been recorded in the wild but are not clearly established or naturalized, even if successful reproduction of some of these species may have been observed but population are not self-sustaining.

**Established (naturalised) species:** means that it has been successfully introduced in natural, seminatural or man-made environments (i.e. reservoirs, ponds, etc.) “with self-sustaining populations for several life-cycles in the wild, individuals surviving and reproducing either in the location where it was introduced or at multiple sites” (Richardson et al. 2010, Blackburn et al. 2011).

**Cryptogenic:** should be applied to taxa for which it is unclear whether individuals present at a location are native or alien (IUCN 2020), i.e. “species of unknown (or controversial) biogeographical history which cannot be ascribed as being native or alien” (Richardson et al. 2010).

## 2.3. Assessment and species screening

The information on alien species of the Iberian Peninsula is scattered across various sources, including scientific literature, online and offline databases, regional and national competent authorities, etc. In addition, taxonomic, nomenclatural or biological information errors of taxa are, unfortunately, common in various sources of information. Addressing this challenge, we followed a participatory method with experts to identify issues, agree on methodologies and progress by consensus. The LIFE INVASAQUA Project coordinated the process and supported channels of communication or discussion spaces in the expert´s workshops and web-meetings.

Three workshops and six web-meetings were held from January 2019 to October 2020. These events mainly focused on developing the criteria for screening and species inclusion, discussion on the process and agreement about the final List. Finally, the data were edited, and outstanding questions were resolved through communication with experts.

A total of 60 experts in conservation biology from Spain and Portugal took part in the overall process, some of them only in the preliminary phases (Steps 1 and 2). Participants were experienced in biological invasions, many of them in the Mediterranean environments, and covered a range of different taxa and biome types with a track record of work or research in the interaction of science and management (see appendix List of Authors affiliations).


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

We followed a structured step-approach (BOX 2) combining alien invasive knowledge with the collaborative expert identification and consolidation before mentioned.

### Step 1. Systematic review and working groups composition.

Scientific literature, technical reports, IAS databases and other web sources were systematically screened to obtain a preliminary list of alien species that have been recorded in the Iberian estuarine and inland waters. This preliminary review was developed by the LIFE INVASAQUA project staff for a period of approximately four months. Several regional and national competent authorities and some scientist supported the compilation by providing inventories on species.

Experts were allocated to working groups based on their expertise which overall provided comprehensive coverage of taxa and the main environments (estuarine, brackish and inland waters). Each group had at least two co-leaders (researchers with relevant invasion biology expertise) to coordinate or to resolve doubts in the taxa inclusion process (i.e. some brackish species were considered by more than one group).

Several national (Spain and Portugal) and international institutions have produced IAS inventories, and databases, which were assessed (i.e. Spanish IAS catalog, Spanish Allochthonous List, Portuguese National List of IAS) (see Supplementary material). Among other international platforms (see Supplementary material), the European Alien Species Information Network (EASIN) facilitated the access to data on some species (Katsanevakis et al. 2015).

### Step 2. Preliminary list compiled by expert consolidation.

The task of compiling the preliminary list was divided by thematic work groups and taxonomically. Each expert of the thematic groups was given the task of reviewing the preliminary list. Over a period of six months the experts completed this initial exercise by email and web-meetings. Similar lists generated from previous scientific studies in the Iberian Peninsula were circulated to all working groups (e.g. García-Berthou et al. 2007, Cobo et al. 2010, Chainho et al. 2015, Anastácio et al. 2019, Muñoz-Mas & García-Berthou 2020).

### Step 3. Uncertainties discrimination and taxa status definition.

Experts collected additional information to assess the invasion stage and thus to define the status of each recorded species (i.e. established, uncertain or cryptogenic). Specific information on each species from various sources such as scientific papers, IAS databases and technical reports were analysed to consolidate the step by the coordinating team of the process. Retroactive corrections to the defined status were made on several occasions by expert suggestions.

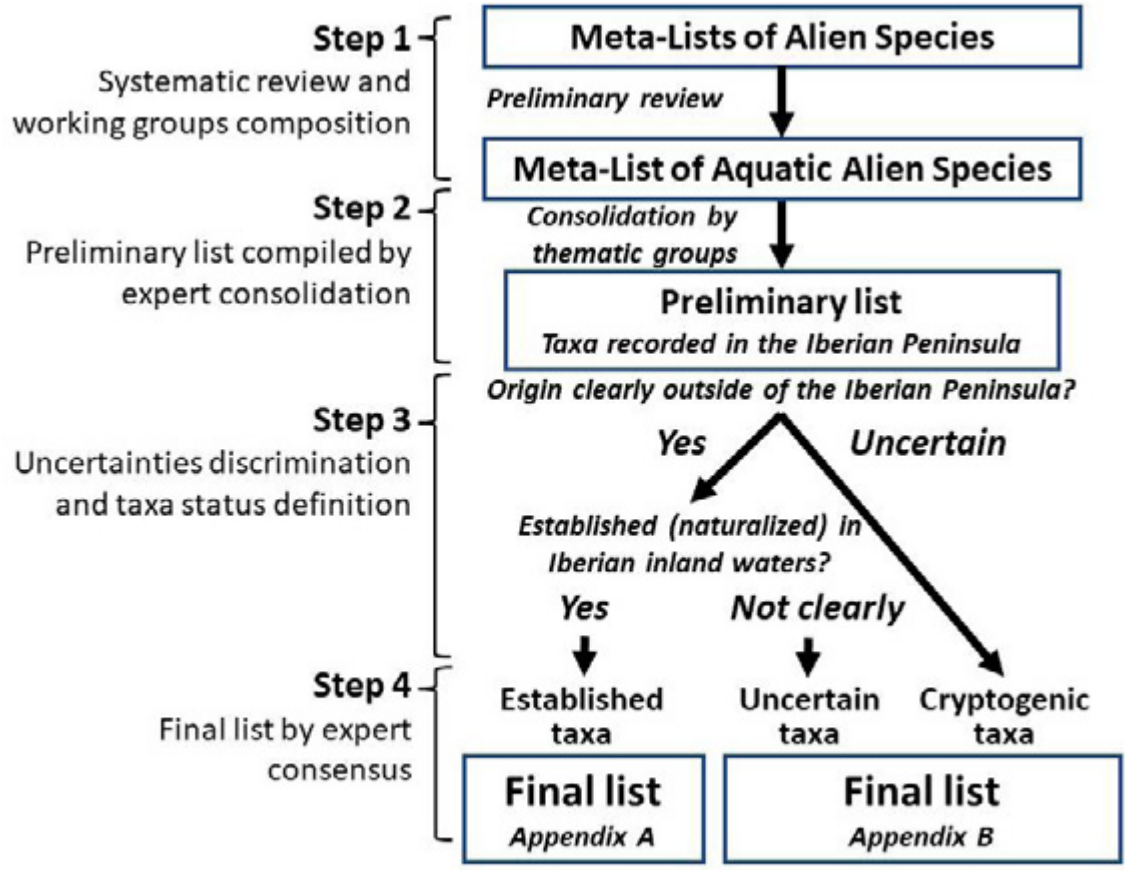
### Step 4. Final list by expert consensus across the thematic groups.

Consensus building across the working groups took place at a final web-meeting. However, experts were then given the opportunity to revise the final List and specifically check the status of each alien species.

The resulting List is a product of scientific consensus concerning species invasion status and is supported by relevant literature and data sources. For all listed alien species, the following data were compiled:

- Scientific name
- Taxonomic classification (Phylum, Class, Order and Family)
- Synonyms (only for taxa with well-established synonym commonly used) (in Supplementary database)
- Group assigned (vertebrates, invertebrates, plants, macroalgae, fungi)
- Native geographic range (in Supplementary database)
- Invasion status (established, uncertain, cryptogenic)
- Inclusion in IAS Regulation (Union List, Spanish IAS catalog, Spanish Allochthonous List, Portuguese National List of IAS) (in Supplementary database)
- Key literature references (in Supplementary database)

**BOX 2 – Structured step-approach of the assessment.**



# 3 Results

# 3. Results

## 3.1. List

The List includes 306 alien species recorded in the inland waters of the Iberian Peninsula (Figure A). From that list, we identified 200 taxa clearly established or naturalised in the estuarine and continental aquatic systems (Appendix A), whereas another 106 taxa were defined as having an uncertain status (Appendix B) (Figure A).

The updated List of species included 24.8% of vertebrates (76 taxa, 41 of them as established), 53.6% of invertebrates (164 taxa, 115 of them as established), 11.5% of plants (35 taxa, 27 of them as established), 9.1% of macroalgae (28 taxa, 15 of them as established), and 1% of fungi (3 taxa, 2 of them as established) (Figure A).

Although it is understood that the rules and regulations do not have to involve all the registered alien species in the Iberian inland waters, it should stand out that only 7.2% of the defined taxa in the present updated List are included in the List of Invasive Alien Species of Union concern (the Union List) which is the core of the IAS Regulation. Similarly, at a national level, the Spanish IAS catalog and the Portuguese National List of IAS only involve 27.1% and 30.1%, respectively, of the taxa. Finally, the Spanish Allochthonous List, which is focused on potential species, reflects the higher percentage of the taxa included in the List of the present study (48.3% of the total).

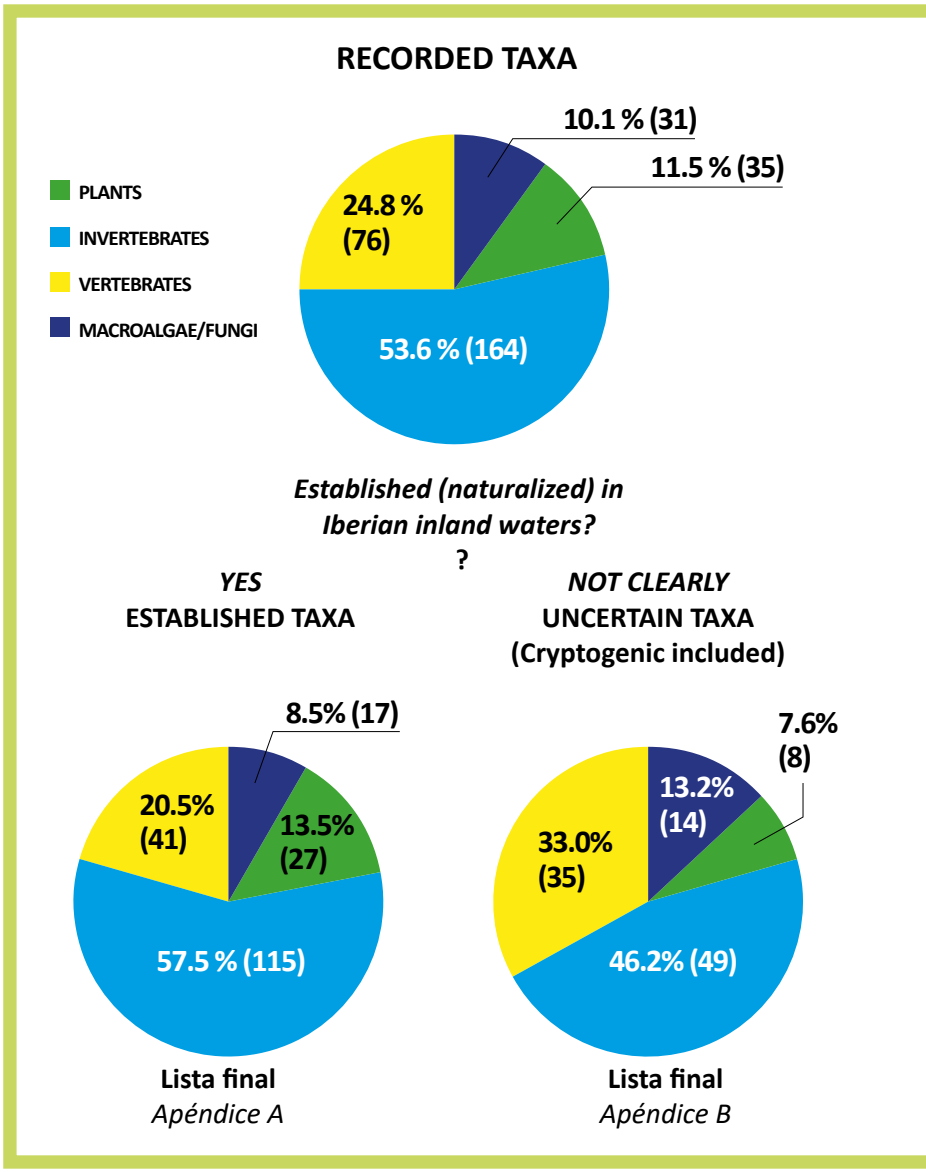



**Figure A.** Relative frequency (in colored pie charts) and total number (in brackets) of alien taxa defined as established and uncertain (cryptogenic taxa are included here) in the outcoming updated List.

## 3.2. Taxonomic approach

Aquatic taxa included in the List belong to 16 phyla divided into 38 classes (orders and families assigned to each species in Appendix A and B). The number of species defined as established or uncertain status by phylum and class are presented in Table A (Appendix C includes the number of species also defined by orders).

The taxa most represented in the List were Chordata 27.4% (23.6% of the established taxa), followed by Arthropoda 21.9% (23.3%), Mollusca 13.4% (15.0%), and Magnoliophyta 10.5% (13.0%) (Table A). Each group of Annelida, Platyhelminthes and Rhodophyta showed an approximate average between 5% and 7% of the listed species, and only a few species have been reported for other minor taxonomic groups.

Overall, Actinopterygii 13.9% (17.1% of established), Malacostraca 9.8% (6.2%), Gastropoda 7.8% (8.3%), Liliopsida 6.2% (7.7%) and Florideophyceae 6.8% (6.2%) were the classes showing highest percentages of records, also in reference to established taxa (Table A). There is a very low proportion of species (2.6%) for which there is no certainty about their native or introduced status (cryptogenic taxa).

The majority of the 76 vertebrates listed here are fish (Actinopterygii in Table A), 32 species are established and 10 are of uncertain status, being Cypriniforms the dominant order with 19 species (50% of established) in that group. Following those, reptiles were the largest group although only one taxon is considered established, and at least 12 species showed several records but there is still no certainty that they have successfully naturalised in Iberian inland waters. Something similar has been observed in the case of birds, showing one established and 7 taxa with uncertain status.

Most of the invertebrates included in the List are crustaceans (62 species, 37.8% of listed invertebrates) and molluscs (41 species, 25.0%) (Table A). Malacostraca and Ostracoda are the dominant groups among the first, and Gastropoda and Bivalvia represented 97.6% of the second. Due to some difficulties involved in the study of aquatic invertebrates, and notwithstanding the increased scientific interest for biological invasions in the last decades, there is still a significant gap of knowledge about alien invertebrates and some functional groups in the Iberian waters. For instance, it should be assumed that a clear underestimate of parasitic and ectocommensal taxa of invertebrates is present on the List.

The updated list mainly includes submerged, floating and emergent aquatic plants, which are included in the categories of hydrophytes and helophytes. Nevertheless, some other taxa, which can withstand flooding well and that are able to grow with part of their vegetative structure submerged or floating, are also considered due to their high invasive potential. Magnoliophyta was clearly dominant with 32 species listed (19 Liliopsida and 13 Magnoliopsida) and only 3 taxa represented the group of Pteridophyta (Table A).

Among macroalgae, clearly Rhodophyta was the dominant group (21 species) but the 42.8% were considered of uncertain status. This reflects part of the difficulties in the assessment of invasion processes for these taxonomic groups and its complicated species detection. Similarly to symbiotic invertebrates, the number of registered macroalgae could also be considered as underestimated.

In general, the existence of taxonomic-related biases among alien species detections due to knowledge gaps can be confirmed with the data presented here. It is quite likely that some taxonomic groups of species, particularly diverse and able to thrive in inland waters, were underrepresented (e.g. annelids, nematodes, plathelmyntes, chlorophytes or ochrophytes). The effort invested to characterise some types of communities in several and different aquatic systems has been low and scattered, which may have led to a lower number of records. Consequently, although the updated List can be considered exhaustive and complete regarding the available information, the current number of exotic species occurring in Iberian inland waters is still likely to be larger than the listed herein.

**Table A.** Number of aquatic alien taxa included in the List by taxonomic groups (Phylum and Class). Number of total, and taxa defined as established, uncertain and cryptogenic status are presented.

| | | | | Appendix A | Appendix B | |
|---|---|---|---|---|---|---|
| **Groups** | **Phylum** | **Class** | **Total** | **Established** | **Uncertain** | **Cryptogenic** |
| VERTEBRATES | **Chordata** | | 76 | 41 | 34 | 1 |
| | | Actinopterygii | 42 | 32 | 10 | 0 |
| | | Amphibia | 8 | 3 | 5 | 0 |
| | | Reptilia | 13 | 1 | 12 | 0 |
| | | Aves | 8 | 1 | 7 | 0 |
| | | Mammalia | 5 | 4 | 0 | 1 |
| INVERTEBRATES | **Chordata** | | 8 | 6 | 2 | 0 |
| | | Ascidiacea | 8 | 6 | 2 | 0 |
| | **Annelida** | | 14 | 7 | 7 | 0 |
| | | Clitellata | 5 | 3 | 2 | 0 |
| | | Polychaeta | 9 | 4 | 5 | 0 |
| | **Arthropoda** | | 67 | 45 | 20 | 2 |
| | | Branchipoda | 3 | 3 | 0 | 0 |
| | | Hexanauplia | 4 | 3 | 1 | 0 |
| | | Ichthyostraca | 1 | 1 | 0 | 0 |
| | | Insecta | 5 | 5 | 0 | 0 |
| | | Malacostraca | 30 | 12 | 17 | 1 |
| | | Ostracoda | 19 | 17 | 1 | 1 |
| | | Theocostraca | 5 | 4 | 1 | 0 |
| | **Bryozoa** | | 7 | 5 | 2 | 0 |
| | | Gymnolaemata | 6 | 5 | 1 | 0 |
| | | Phylactolaemata | 1 | 0 | 1 | 0 |
| | **Cnidaria** | | 6 | 5 | 1 | 0 |
| | | Anthozoa | 1 | 1 | 0 | 0 |
| | | Hydrozoa | 5 | 4 | 1 | 0 |
| | **Ctenophora** | | 1 | 1 | 0 | 0 |
| | | Tentaculata | 1 | 1 | 0 | 0 |
| | **Mollusca** | | 41 | 29 | 11 | 1 |
| | | Bivalvia | 16 | 13 | 3 | 0 |
| | | Gastropoda | 24 | 16 | 7 | 1 |
| | | Polyplacophora | 1 | 0 | 1 | 0 |
| | **Nematoda** | | 2 | 0 | 1 | 1 |
| | | Chromadorea | 1 | 0 | 0 | 1 |
| | | Secernentea | 1 | 0 | 1 | 0 |
| | **Platyhelminthes** | | 18 | 17 | 1 | 0 |
| | | Cestoda | 1 | 1 | 0 | 0 |
| | | Monogenea | 11 | 10 | 1 | 0 |
| | | Rhabditophora | 2 | 2 | 0 | 0 |
| | | Trematoda | 4 | 4 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| PLANTS | **Magnoliophyta** | | 32 | 26 | 5 | 1 |
| | | Liliopsida | 19 | 16 | 2 | 1 |
| | | Magnoliopsida | 13 | 10 | 3 | 0 |
| | **Pteridophyta** | | 3 | 1 | 1 | 1 |
| | | Polypodiopsida | 3 | 1 | 1 | 1 |
| MACROALGAE | **Chlorophyta** | | 3 | 1 | 2 | 0 |
| | | Ulvophyceae | 1 | 1 | 0 | 0 |
| | **Ochrophyta** | | 4 | 2 | 2 | 0 |
| | | Phaeophyceae | 4 | 2 | 2 | 0 |
| | **Rhodophyta** | | 21 | 12 | 8 | 1 |
| | | Florideophyceae | 21 | 12 | 8 | 1 |
| FUNGI | **Oomycota** | | 2 | 1 | 0 | 1 |
| | | Oomycetes | 2 | 1 | 0 | 1 |
| | **Chytridiomycota** | | 1 | 1 | 0 | 0 |
| | | Chytridiomycetes | 1 | 1 | 0 | 0 |
| | **Total** | 38 classes | 306 | 200 | 97 | 9 |

Golden apple snail (*Pomacea* sp.) © BETTAS ZERO. CC BY-NC

**BOX 3 – Examples of alien species listed as established in Iberian inland waters**

## American mink
## *Neovison vison* (Schreber, 1777)

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The American mink is clearly established in aquatic systems from the Iberian Peninsula being an example of an invasive alien species causing impacts on biodiversity and economic activities. The impact on biodiversity of this semi-aquatic carnivore of the Mustelids family, introduced in Europe from North America for the fur trade, can be severe. The main ways this generalist and opportunistic predator is affecting native species is through competition and predation, causing devastating effects on some birds, especially colonial species, but also small mammals. This species can inflict damage also on some human activities, particularly on fish cultures as well as on free animal farms (i.e. chickens, etc.), and reared game birds. In fact, its economic impact could be locally important. Another impact of the American mink is related to its role as disease vector for other mustelids (e.g. Aleutian disease). Other diseases associated with the species are rabies, distemper and mink enteritis virus among others, but little is known about them and their potential effect on human health. However, human cases of COVID-19 have been recently identified in Europe with SARS-CoV-2 variants associated with farmed minks (Enserink 2020).

# European catfish
## *Silurus glanis* Linnaeus, 1758

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The European catfish is established in four of the largest river drainages of the Iberian Peninsula (Ebro, Duero, Tagus and Guadalquivir) and in other smaller drainages in the Northeastern and Eastern areas. The European catfish was initially detected in the lower Ebro in 1974, being posteriorly introduced in upper Tagus (1998) and in Catalonian rivers (2000). It also occurs in the Duero river and, more recently (2013), occurring in Guadalquivir river in two different locations. This catfish is the third largest freshwater fish attaining 2.8 m long and up to 120 kg of weight, being considered a top-predatory fish. The impacts to local biodiversity are probably high given their predatory habits, where the smaller catfish (<1 meter) eat predominantely crustaceans (crayfish and shrimp) and fishes, while the larger fish (>1m) eat almost exclusively fish. There is a bulk of evidence that this invasive fish targets spawning areas of shads, sea-lamprey and native barbels, potentially causing high population declines of these species and loss of income to professional fishermen. Also, the large catfish aggregations observed (shoals of 60 of large individuals) in several reservoirs could create high concentrations of nitrogen and reduce water quality of drinking water. Little is known about pathogen transmission of the catfish to native fishes.

# Red swamp crayfish
# *Procambarus clarkii* (Girard, 1852)

© Javier Murcia Requena

The Red swamp crayfish is widespread throughout most of the river basins in the Iberian Peninsula. It is a North American species, introduced into Spain in 1973 for aquaculture. Since then it spread autonomously within river basins. It can easily move out of water and therefore isolated water bodies are often colonised. The species has been illegally transported by humans among river basins and very small juveniles can be transported by mud in vehicles, fishing gear or even water birds. The red swamp crayfish currently has an intense associated trade for human consumption. The species has strong negative effects on aquatic macroinvertebrates, amphibians and macrophytes but has become a valuable food source for several aquatic predators which are now very dependent on it. It is a pest in rice fields due to its burrowing behavior, which induces water loss, but also because it consumes rice seeds and seedlings. Densities of 1 adult per m² at rice sowing can reduce rice production by 42% and 3 adults per m² can reduce rice production to zero. In Portugal, due to red swamp crayfish, an approximate annual cost of €1.3M in rice agriculture can be estimated using 2018 production areas and in Spain it could be €4.5M if the same economic impact per ha is assumed.

# Zebra mussel
# *Dreissena polymorpha* (Schreber, 1777)

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Native to the lakes of southern Russia and Ukraine, the zebra mussel has been introduced in many countries worldwide, becoming one of the worst invasive species in the planet. Their biological success is due to their ability to reproduce; a single specimen can produce up to one million eggs per year. The colonising capability of the zebra mussel not only causes serious ecosystem consequences but also a worrying economic impact. Concerning ecological impacts, this freshwater mussel is a filter-feeding organism; removing organic particles from the water column and depositing their faeces on the substrate. Their activity modifies the ecology of aquatic ecosystems changing natural processes of nutrients and biodiversity assemblages. Regarding economic impacts, the dense populations of this mollusc are capable of plugging agricultural, industrial and urban water supplies. A financial report about the investment of this invasive alien species in the Ebro River Basin (the most impacted basin with zebra mussel in the Iberian Peninsula) estimates the cost of €40M to stakeholders during the period between 2006 and 2025.

# Water hyacinth
## *Eichhornia crassipes* (Mart.) Solms

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The water hyacinth or camalote is the paradigm of Aquatic Invasive Plants, all we must do is look at its history. Native from the Amazon basin, in 1884 it was offered as a gift to the visitors of the World's Fair at New Orleans. Since then, this plant has spread all over the world, causing major problems both in the natural environment and in human activity (Lake Victoria, Nile Mouth, Bengal, Bangladesh, etc.). Consequently, the fight against this plant has been relentless, and all kinds of pest control techniques have been tried against camalote, without any clear success. At the end of the 1930s it was located at the mouths of the rivers Sado and Tagus, in Portugal. In Spain, it did not appear until the end of the 20$^{th}$ century, in the Ebro Delta and the Levant. In 2004, camalote was found in the river Guadiana, in the province of Badajoz; there, it grows without constraint (it extends for more than 150 km), despite having spent more than €45M in its control. The problem with this plant lies in its enormous capacity for growth and propagation causing, among others, degradation of water quality, alteration of native communities, flooding and drainage problems, obstruction of hidraulic infrastructures, and interference with both navigation and recreational activities.

# Water fern or fairy moss *Azolla filiculoides* Lam.

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The water fern is a floating aquatic heterosporic pteridophyte (1 - 2.5 cm) with bilobed fronds whose ventral lobe is very thin, achlorophyllic and submerged while the dorsal, aerial and with chlorophyll, has an extracellular cavity in which there is, in symbiosis, a cyanobacteria (*Anabaena azollae*) able to fix nitrogen. Its colour ranges from red or purple in full sun to pale green or bluish green in the shadiest areas. It is native of North and Central America and has been expanding in the Iberian Peninsula since its introduction at the beginning of the 20$^{th}$ century. It produces damage to the ecosystem as it is a typical pleustophyte that forms thick tapestries on the surface of the water and makes the submerged vegetation and the periphyton disappear because of competition for light. The capacity of the symbiotic cyanobacteria to fix atmospheric nitrogen also produces a rapid eutrophication of the water. It can cause damage to human activities, especially to water abstraction structures, navigation, fishing, recreational activities, etc.

# 4 Recommendations and needs for update

# 4. Recommendations and needs for update

LIFE INVASAQUA Project has proved to be a good source of information supporting the implementation of the IAS Regulation, and provides a factual basis for the review of regional enforcement. We believe that the updated List will help Spain and Portugal support the EU Regulation implementation on IAS by engaging and creating synergies between knowledge building and management. However, assessment of the invasive risk and establishment of management priorities may be related but are distinct processes.

The List is a dynamic tool that will evolve with time according to new information or situations. It is aimed at stimulating and supporting research, monitoring, management and control actions at local, regional and trans-national levels. The resulting updated List is part of a wider LIFE INVASAQUA initiative aimed at assessing the status of many Iberian aquatic alien species. This initiative will provide key resources for decision-makers, environmental managers, NGOs, and other stakeholders by compiling information on the population, ecology, habitats and recommended management measures for several IAS. The outputs can be applied to inform policy, and to identify priority IAS to include in monitoring programmes and research, and to identify priority areas to include in management plans. All the information generated by the LIFE INVASAQUA project will be freely available on its related websites (http://www.lifeinvasaqua.com/; https://eei.sibic.org/; http://www.ibermis.org/), and/or through different technical reports.

Ultimately, in order to highlight the most emerging IAS in the Iberian inland waters, a new approach is required to prioritise the threat posed by the established taxa and also by potentially new IAS which are not yet established. In this context, LIFE INVASAQUA has developed a trans-national horizon scanning exercise that will be the subject of a new Technical Report (Oliva-Paterna et al. 2020).

### Some final recommendations

- Use the List to inform revisions and implementation of relevant European, National and Regional legislation.
- Improve EU, National and Regional Management Organizations and other stakeholders requirements for species-specific reporting of occurrences and catches of all species included in the lists, and for quality assurance of these data so that improved analyses of long-term trends can be undertaken.
- For those groups with taxonomic problems or difficulties, improved species identification is required in all monitoring program as well as scientific surveys. For that purpose, trainings of species identification for stakeholders or key groups, such as surveillance agents, should be provided.
- Revise the List regularly, and whenever new information of alien taxa becomes available.
- Conduct basic and applied biological research for the included alien species, especially those that have most need of control and management.

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# Appendix A

## List of aquatic alien species with a status of established (naturalised) in Iberian inland waters

List of introduced taxa that have been recorded in the Iberian inland waters where they have wild and self-sustaining populations (status **= established**). More information about taxa (synonyms, native geographic range, inclusion in IAS Regulation and key literature references) is included in the supplementary database (http://www.ibermis.org/) (http://www.lifeinvasaqua.com/).

| VERTEBRATES | | | | |
|---|---|---|---|---|
| **Scientific Name** | **Phylum** | **Class** | **Order** | **Family** |
| *Abramis brama* (Linnaeus, 1758) | Chordata | Actinopterygii | Cypriniformes | Cyprinidae |
| *Alburnus alburnus* (Linnaeus, 1758) | Chordata | Actinopterygii | Cypriniformes | Cyprinidae |
| *Alopochen aegyptiaca* (Linnaeus, 1766) | Chordata | Aves | Anseriformes | Anatidae |
| *Ameiurus melas* (Rafinesque, 1820) | Chordata | Actinopterygii | Siluriformes | Ictaluridae |
| *Australoheros facetus* (Jenyns, 1842) | Chordata | Actinopterygii | Perciformes | Cichlidae |
| *Barbatula barbatula* (Linnaeus, 1758) | Chordata | Actinopterygii | Cypriniformes | Nemacheilidae |
| *Blicca bjoerkna* (Linnaeus, 1758) | Chordata | Actinopterygii | Cypriniformes | Cyprinidae |
| *Carassius auratus* (Linnaeus, 1758) | Chordata | Actinopterygii | Cypriniformes | Cyprinidae |
| *Carassius gibelio* (Bloch, 1782) | Chordata | Actinopterygii | Cypriniformes | Cyprinidae |
| *Cobitis bilineata* Canestrini, 1865 | Chordata | Actinopterygii | Cypriniformes | Cobitidae |
| *Cynoscion regalis* (Bloch & Schneider, 1801) | Chordata | Actinopterygii | Perciformes | Sciaenidae |
| *Cyprinus carpio* Linnaeus, 1758 | Chordata | Actinopterygii | Cypriniformes | Cyprinidae |
| *Discoglossus pictus* Otth, 1837 | Chordata | Amphibia | Anura | Alytidae |
| *Esox lucius* Linnaeus, 1758 | Chordata | Actinopterygii | Esociformes | Esocidae |
| *Fundulus heteroclitus* (Linnaeus, 1766) | Chordata | Actinopterygii | Cyprinodontiformes | Fundulidae |
| *Gambusia holbrooki* Girard, 1859 | Chordata | Actinopterygii | Cyprinodontiformes | Poeciliidae |
| *Gobio occitaniae* Kottelat & Persat, 2005 | Chordata | Actinopterygii | Cypriniformes | Cyprinidae |
| *Ictalurus punctatus* (Rafinesque, 1818) | Chordata | Actinopterygii | Siluriformes | Ictaluridae |
| *Lepomis gibbosus* (Linnaeus, 1758) | Chordata | Actinopterygii | Perciformes | Centrarchidae |
| *Leuciscus aspius* (Linnaeus, 1758) | Chordata | Actinopterygii | Cypriniformes | Cyprinidae |
| *Micropterus salmoides* (Lacepède, 1802) | Chordata | Actinopterygii | Perciformes | Centrarchidae |
| *Misgurnus anguillicaudatus* (Cantor, 1842) | Chordata | Actinopterygii | Cypriniformes | Cobitidae |
| *Myocastor coypus* (Molina, 1782) | Chordata | Mammalia | Rodentia | Myocastoridae |
| *Neovison vison* (Schreber, 1777) | Chordata | Mammalia | Carnivora | Mustelidae |
| *Oncorhynchus mykiss* (Walbaum, 1792) | Chordata | Actinopterygii | Salmoniformes | Salmonidae |
| *Ondatra zibethicus* (Linnaeus, 1766) | Chordata | Mammalia | Rodentia | Cricetidae |
| *Pelophylax* kl. *grafi* (Crochet, Dubois, Ohler&Tunner, 1995) | Chordata | Amphibia | Anura | Ranidae |
| *Perca fluviatilis* Linnaeus, 1758 | Chordata | Actinopterygii | Perciformes | Percidae |
| *Phoxinus septimaniae* Kottelat, 2007 | Chordata | Actinopterygii | Cypriniformes | Cyprinidae |
| *Procyon lotor* (Linnaeus, 1758) | Chordata | Mammalia | Carnivora | Procyonidae |
| *Pseudorasbora parva* (Temminck & Schlegel, 1846) | Chordata | Actinopterygii | Cypriniformes | Cyprinidae |
| *Rutilus rutilus* (Linnaeus, 1758) | Chordata | Actinopterygii | Cypriniformes | Cyprinidae |
| *Salvelinus fontinalis* (Mitchill, 1814) | Chordata | Actinopterygii | Salmoniformes | Salmonidae |
| *Salvelinus umbla* (Linnaeus, 1758) | Chordata | Actinopterygii | Salmoniformes | Salmonidae |
| *Sander lucioperca* (Linnaeus, 1758) | Chordata | Actinopterygii | Perciformes | Percidae |
| *Scardinius erythrophthalmus* (Linnaeus, 1758) | Chordata | Actinopterygii | Cypriniformes | Cyprinidae |
| *Silurus glanis* Linnaeus, 1758 | Chordata | Actinopterygii | Siluriformes | Siluridae |
| *Tinca tinca* (Linnaeus, 1758) | Chordata | Actinopterygii | Cypriniformes | Cyprinidae |
| *Trachemys scripta* (Thunberg in Schoepff, 1792) | Chordata | Reptilia | Testudines | Emydidae |
| *Xenopus laevis* (Daudin, 1802) | Chordata | Amphibia | Anura | Pipidae |
| *Xiphophorus maculatus* (Günther, 1866) | Chordata | Actinopterygii | Cyprinodontiformes | Poeciliidae |

| INVERTEBRATES | | | | |
|---|---|---|---|---|
| **Scientific Name** | **Phylum** | **Class** | **Order** | **Family** |
| *Acartia (Acanthacartia) tonsa* Dana , 1849 | Arthropoda | Hexanauplia | Calanoida | Acartidae |
| *Aedes albopictus* (Skuse, 1895) | Arthropoda | Insecta | Diptera | Culicidae |
| *Aedes japonicus* (Theobald, 1901) | Arthropoda | Insecta | Diptera | Culicidae |
| *Alpheus* sp1 Fabricius, 1798 | Arthropoda | Malacostraca | Decapoda | Alpheidae |
| *Amathia verticillata* (delle Chiaje, 1822) | Bryozoa | Gymnolaemata | Ctenostomatida | Vesicularioidea |
| *Amphibalanus amphitrite* (Darwin, 1854) | Arthropoda | Theocostraca | Sessilia | Balanidae |
| *Amphibalanus improvisus* (Darwin, 1854) | Arthropoda | Theocostraca | Sessilia | Balanidae |
| *Anadara kagoshimensis* (Tokunaga, 1906) | Mollusca | Bivalvia | Arcida | Arcidae |
| *Anadara transversa* (Say, 1822) | Mollusca | Bivalvia | Arcida | Arcidae |
| *Ankylocythere sinuosa* (Rioja, 1942) | Arthropoda | Ostracoda | Podocopida | Entocytheridae |
| *Arcuatula senhousia* (Benson, 1842) | Mollusca | Bivalvia | Mytilida | Mytilidae |
| *Argulus japonicus* Thiele, 1900 | Arthropoda | Ichthyostraca | Arguloida | Arguilidae |
| *Artemia franciscana* Kellogg, 1906 | Arthropoda | Branchipoda | Anostraca | Artemiidae |
| *Austrominius modestus* (Darwin, 1854) | Arthropoda | Theocostraca | Sessilia | Austrobalanidae |
| *Balanus trigonus* Darwin, 1854 | Arthropoda | Theocostraca | Sessilia | Balanidae |
| *Barbronia weberi* (Blanchard, 1897) | Annelida | Clitellata | Euhirudinea | Salifidae |
| *Blackfordia virginica* Mayer, 1910 | Cnidaria | Hydrozoa | Leptothecata | Blackfordiidae |
| *Bosmina (Eubosmina) coregoni* Baird, 1857 | Arthropoda | Branchipoda | Diplostraca | Bosminidae |
| *Branchiura sowerbyi* Beddard, 1892 | Annelida | Clitellata | Haplotaxida | Naididae |
| *Bugula neritina* (Linnaeus, 1758) | Bryozoa | Gymnolaemata | Cheilostomatida | Bugulidae |
| *Bugulina stolonifera* (Ryland, 1960) | Bryozoa | Gymnolaemata | Cheilostomatida | Bugulidae |
| *Bulinus truncatus* (Audouin, 1827) | Mollusca | Gastropoda | Unassigned | Bulinidae |
| *Bursatella leachii* Blainville, 1817 | Mollusca | Gastropoda | Aplysiida | Aplysiidae |
| *Callinectes sapidus* Rathbun, 1896 | Arthropoda | Malacostraca | Decapoda | Portunidae |
| *Candonocypris novaezelandiae* (Baird, 1843) | Arthropoda | Ostracoda | Podocopida | Cyprididae |
| *Cherax destructor* Clark, 1936 | Arthropoda | Malacostraca | Decapoda | Parastacidae |
| *Cherax quadricarinatus* (Von Martens, 1868) | Arthropoda | Malacostraca | Decapoda | Parastacidae |
| *Corbicula fluminea* (Müller, 1774) | Mollusca | Bivalvia | Venerida | Cyrenidae |
| *Cordylophora caspia* (Pallas, 1771) | Cnidaria | Hydrozoa | Anthoathecata | Cordylophoridae |
| *Corella eumyota* Traustedt, 1882 | Chordata | Ascidiacea | Phlebobranchia | Corellidae |
| *Crangonyx pseudogracilis* Bousfield, 1958 | Arthropoda | Malacostraca | Amphipoda | Crangonyctidae |
| *Craspedacusta sowerbii* Lankester, 1880 | Cnidaria | Hydrozoa | Limnomedusae | Olindiidae |
| *Crepidula fornicata* (Linnaeus, 1758) | Mollusca | Gastropoda | Littorinimorpha | Calyptraeidae |
| *Crepipatella dilatata* (Lamarck, 1822) | Mollusca | Gastropoda | Littorinimorpha | Calyptraeidae |
| *Culicoides paloae* Boorman, 1996 | Arthropoda | Insecta | Diptera | Ceratopogonidae |
| *Cypretta seurati* Gauthier, 1929 | Arthropoda | Ostracoda | Podocopida | Cyprididae |
| *Cypris subglobosa* Sowerby, 1840 | Arthropoda | Ostracoda | Podocopida | Bythocytheridae |
| *Dactylogyrus anchoratus* (Dujardin, 1845) | Platyhelminthes | Monogenea | Dactylogyridea | Dactylogyridae |
| *Dendrocoelum lacteum* (Müller, 1774) | Platyhelminthes | Rhabditophora | Tricladida | Dendrocoelidae |
| *Desdemona ornata* Banse, 1957 | Annelida | Polychaeta | Sabellida | Sabellidae |
| *Diadumene lineata* (Verrill, 1869) | Cnidaria | Anthozoa | Actiniaria | Diadumenidae |
| *Didemnum vexillum* Kott, 2002 | Chordata | Ascidiacea | Aplousobranchia | Didemnidae |
| *Dolerocypris sinensis* G. O. Sars, 1903 | Arthropoda | Ostracoda | Podocopida | Cyprididae |
| *Dreissena polymorpha* (Pallas, 1771) | Mollusca | Bivalvia | Myida | Dreissenidae |
| *Ensis leei* M. Huber, 2015 | Mollusca | Bivalvia | Adapedonta | Pharidae |
| *Eriocheir sinensis* H. Milne Edwards, 1853 | Arthropoda | Malacostraca | Decapoda | Varunidae |
| *Fabaeformiscandona subacuta* (Yang, 1982) | Arthropoda | Ostracoda | Podocopida | Candonidae |
| *Faxonius limosus* (Rafinesque, 1817) | Arthropoda | Malacostraca | Decapoda | Cambaridae |
| *Ferrissia californica* (Rowell, 1863) | Mollusca | Gastropoda | Basommatophora | Planorbidae |
| *Ficopomatus enigmaticus* (Fauvel, 1923) | Annelida | Polychaeta | Sabellida | Serpulidae |
| *Girardia tigrina* (Girard, 1850) | Platyhelminthes | Rhabditophora | Tricladida | Dugesiidae |
| *Gyraulus chinensis* (Dunker, 1848) | Mollusca | Gastropoda | Basommatophora | Planorbidae |
| *Gyrodactylus cyprini* Diarova, 1964 | Platyhelminthes | Monogenea | Gyrodactylidea | Gyrodactylidae |

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|---|---|---|---|---|
| *Gyrodactylus kathariner*i Malmberg, 1964 | Platyhelminthes | Monogenea | Gyrodactylidea | Gyrodactylidae |
| *Gyrodactylus salaris* Malmberg, 1957 | Platyhelminthes | Monogenea | Gyrodactylidea | Gyrodactylidae |
| *Hemicypris barbadensis* Broodbaker, 1983 | Arthropoda | Ostracoda | Podocopida | Cyprididae |
| *Hemicypris reticulata* (Klie, 1930) | Arthropoda | Ostracoda | Podocopida | Cyprididae |
| *Heterocypris bosniaca* Petkovski, Scharf & Keiser, 2000 | Arthropoda | Ostracoda | Podocopida | Cyprididae |
| *Ilyodromus viridulus* (Brady, 1886) | Arthropoda | Ostracoda | Podocopida | Cyprididae |
| *Isocypris beauchampi* (Paris, 1920) | Arthropoda | Ostracoda | Podocopida | Cyprididae |
| *Lernaea cyprinacea* Linnaeus, 1758 | Arthropoda | Hexanauplia | Cyclopoida | Lernaeidae |
| *Maeotias marginata* (Modeer, 1791) | Cnidaria | Hydrozoa | Limnomedusae | Olindiidae |
| *Magallana angulata* (Lamarck, 1819) | Mollusca | Bivalvia | Ostreida | Otreidae |
| *Magallana gigas* (Thunberg, 1793) | Mollusca | Bivalvia | Ostreida | Otreidae |
| *Marisa cornuarietis* (Linnaeus, 1758) | Mollusca | Gastropoda | Architaenioglossa | Ampullariidae |
| *Melanoides tuberculata* (O. F. Müller, 1774) | Mollusca | Gastropoda | Neotaenioglossa | Thiaridae |
| *Microcosmus squamiger* Michaelsen, 1927 | Chordata | Ascidiacea | Stolidobranchia | Pyuridae |
| *Mnemiopsis leidyi* A. Agassiz, 1865 | Ctenophora | Tentaculata | Lobata | Bolinopsidae |
| *Mya arenaria* Linnaeus, 1758 | Mollusca | Bivalvia | Myida | Myidae |
| *Mytilopsis leucophaeata* (Conrad, 1831) | Mollusca | Bivalvia | Myida | Dreissenidae |
| *Neopolystoma orbiculare* (Stunkard, 1916) | Platyhelminthes | Monogenea | Polystomatidea | Polystomatidae |
| *Ocinebrellus inornatus* (Récluz, 1851) | Mollusca | Gastropoda | Neogastropoda | Muricidae |
| *Onchocleidus dispar* (Müller, 1936) | Platyhelminthes | Monogenea | Dactylogyridea | Ancyrocephalidae |
| *Onchocleidus similis* (Müller, 1936) | Platyhelminthes | Monogenea | Dactylogyridea | Ancyrocephalidae |
| *Orientogalba viridis* (Quoy & Gaimard, 1833) | Mollusca | Gastropoda | Unassigned | Lymnaeidae |
| *Pacifastacus leniusculus* (Dana, 1852) | Arthropoda | Malacostraca | Decapoda | Astacidae |
| *Palaemon macrodactylus* Rathbun, 1902 | Arthropoda | Malacostraca | Decapoda | Palaemonidae |
| *Phyllodistomum folium* (Olfers, 1816) | Platyhelminthes | Trematoda | Plagiorchiida | Gorgoderidae |
| *Physella acuta* (Draparnaud, 1805) | Mollusca | Gastropoda | Unassigned | Physidae |
| *Planorbella duryi* (Wetherby, 1879) | Mollusca | Gastropoda | Basommatophora | Planorbidae |
| *Polyandrocarpa zorritensis* (Van Name, 1931) | Chordata | Ascidiacea | Stolidobranchia | Styelidae |
| *Pomacea maculata* (Perry, 1810) | Mollusca | Gastropoda | Architaenioglossa | Ampullariidae |
| *Posthodiplostomum centrarchi* Hoffman, 1958 | Platyhelminthes | Trematoda | Diplostomida | Diplstomidae |
| *Potamocypris producta* (Sars, 1924) | Arthropoda | Ostracoda | Podocopida | Cyprididae |
| *Potamopyrgus antipodarum* (J. E. Gray, 1853) | Mollusca | Gastropoda | Littorinimorpha | Tateidae |
| *Prionospio pulchra* Imajima, 1990 | Annelida | Polychaeta | Spionida | Spionidae |
| *Procambarus clarkii* (Girard, 1852) | Arthropoda | Malacostraca | Decapoda | Cambaridae |
| *Protopolystoma xenopodis* (Price, 1943) | Platyhelminthes | Monogenea | Polyopisthocotylea | Polystomatidea |
| *Pseudodactylogyrus anguillae* (Yin & Sproston, 1948) | Platyhelminthes | Monogenea | Dactylogyridea | Pseudodactylogyridae |
| *Pseudodactylogyrus bini* (kikuchi, 1929) | Platyhelminthes | Monogenea | Dactylogyridea | Pseudodactylogyridae |
| *Pseudodiaptomus marinus* Sato, 1913 | Arthropoda | Hexanauplia | Calanoida | Pseudodiaptomidae |
| *Pseudopolydora paucibranchiata* (Okuda, 1937) | Annelida | Polychaeta | Spionida | Spionidae |
| *Pseudosuccinea columella* (Say, 1817) | Mollusca | Gastropoda | Basommatophora | Lymnaeidae |
| *Rhithropanopeus harrisii* (Gould, 1841) | Arthropoda | Malacostraca | Decapoda | Panopeidae |
| *Ruditapes philippinarum* (Adams&Reeve, 1850) | Mollusca | Bivalvia | Venerida | Veneridae |
| *Schyzocotyle acheilognathi* (Yamaguti, 1934) | Platyhelminthes | Cestoda | Bothriocephalidea | Bothricephalidae |
| *Sinanodonta woodiana* (Lea, 1834) | Mollusca | Bivalvia | Unionida | Unionidae |
| *Sinotaia cf quadrata* (Benson, 1842) | Mollusca | Gastropoda | Architaenioglossa | Viviparidae |
| *Spirorchis elegans* Stunkard, 1923 | Platyhelminthes | Trematoda | Diplostomida | Spirorchiidae |
| *Stenocypris macedonica* Petkovaki & Meisch, 1996 | Arthropoda | Ostracoda | Podocopida | Cyprididae |
| *Stenocypris major* (Baird, 1859) | Arthropoda | Ostracoda | Podocopida | Cyprididae |
| *Stenopelmus rufinasus* Gyllenhal, 1835 | Arthropoda | Insecta | Coleoptera | Brachyceridae |
| *Strandesia vavrai* (W. G. Müller, 1898) | Arthropoda | Ostracoda | Podocopida | Cyprididae |
| *Strandesia vinciguerrae* (Masi, 1905) | Arthropoda | Ostracoda | Podocopida | Cyprididae |
| *Styela clava* Herdman, 1881 | Chordata | Ascidiacea | Stolidobranchia | Styelidae |
| *Styela plicata* (Lesueur, 1823) | Chordata | Ascidiacea | Stolidobranchia | Styelidae |
| *Synidotea laticauda* Benedict, 1897 | Arthropoda | Malacostraca | Isopoda | Idoteidae |
| *Telorchis attenuata* Goldberg, 1911 | Platyhelminthes | Trematoda | Plagiorchiida | Telorchiidae |

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|---|---|---|---|---|
| *Tricellaria inopinata* d'Hondt & Occhipinti Ambrogi, 1985 | Bryozoa | Gymnolaemata | Cheilostomatida | Candidae |
| *Trichocorixa verticalis* (Fieber, 1851) | Arthropoda | Insecta | Hemiptera | Corixidae |
| *Uncinocythere occidentalis* (Kozlofff & Whitman, 1954) | Arthropoda | Ostracoda | Podocopida | Entocytheridae |
| *Watersipora* cfr. *subtorquata* (d'Orbigny, 1852) | Bryozoa | Gymnolaemata | Cheilostomatida | Watersiporidae |
| *Wlassiscia pannonica* Daday, 1904 | Arthropoda | Branchipoda | Diplstraca | Macrothoricidae |
| *Xenostrobus securis* (Lamarck, 1819) | Mollusca | Bivalvia | Mytilida | Mytilidae |
| *Xironogiton victoriensis* Gelder & Hall, 1990 | Annelida | Clitellata | Branchiobdellida | Branchiobdellidae |
| **PLANTS** | | | | |
| **Scientific Name** | **Phylum** | **Class** | **Order** | **Family** |
| *Alternanthera philoxeroides* (Mart.) Griseb. | Magnoliophyta | Magnoliopsida | Caryophyllales | Amaranthaceae |
| *Azolla filiculoides* Lam. | Pteridophyta | Polypodiopsida | Salviniales | Salviniaceae |
| *Bacopa monnieri* (L.) Wettst. | Magnoliophyta | Magnoliopsida | Lamiales | Plantaginaceae |
| *Egeria densa* Planch. | Magnoliophyta | Liliopsida | Alismatales | Hydrocharitaceae |
| *Eichhornia crassipes* (Mart.) Solms | Magnoliophyta | Liliopsida | Commelinales | Pontederiaceae |
| *Elodea canadensis* Michx. | Magnoliophyta | Liliopsida | Alismatales | Hydrocharitaceae |
| *Heteranthera limosa* (Sw.) Will. | Magnoliophyta | Liliopsida | Commelinales | Pontederiaceae |
| *Heteranthera reniformis* Ruiz & Pav. | Magnoliophyta | Liliopsida | Commelinales | Pontederiaceae |
| *Heteranthera rotundifolia* (Kunth) Griseb. | Magnoliophyta | Liliopsida | Commelinales | Pontederiaceae |
| *Hydrocotyle bonariensis* Lam. | Magnoliophyta | Magnoliopsida | Apiales | Apiaceae |
| *Hydrocotyle verticillata* Thunb. | Magnoliophyta | Magnoliopsida | Apiales | Apiaceae |
| *Lagarosiphon major* (Ridl.) Moss | Magnoliophyta | Liliopsida | Alismatales | Hydrocharitaceae |
| *Lemna minuta* Kunth | Magnoliophyta | Liliopsida | Alismatales | Araceae |
| *Lemna valdiviana* Phil | Magnoliophyta | Liliopsida | Alismatales | Araceae |
| *Limnobium laevigatum* (Willd.) Heine | Magnoliophyta | Liliopsida | Alismatales | Hydrocharitaceae |
| *Ludwigia grandiflora* (Michx.) Greuter & Burdet | Magnoliophyta | Magnoliopsida | Myrtales | Onagraceae |
| *Ludwigia peploides* subsp. *montevidensis* (Spreng.) P.H.Raven | Magnoliophyta | Magnoliopsida | Myrtales | Onagraceae |
| *Ludwigia repens* J.R. Forst. | Magnoliophyta | Magnoliopsida | Myrtales | Onagraceae |
| *Myriophyllum aquaticum* (Vell.) Verdc. | Magnoliophyta | Magnoliopsida | Saxifragales | Haloragaceae |
| *Myriophyllum heterophyllum* Michx. | Magnoliophyta | Magnoliopsida | Saxifragales | Haloragaceae |
| *Najas gracillima* (A.Braun ex. Engelm.) Magnus | Magnoliophyta | Liliopsida | Alismatales | Hydrocharitaceae |
| *Najas graminea* Delile | Magnoliophyta | Liliopsida | Alismatales | Hydrocharitaceae |
| *Nymphaea mexicana* Zucc. | Magnoliophyta | Magnoliopsida | Nymphaeales | Nymphaeaceae |
| *Pistia stratiotes* L. | Magnoliophyta | Liliopsida | Alismatales | Araceae |
| *Spartina alterniflora* Loisel. | Magnoliophyta | Liliopsida | Poales | Poaceae |
| *Spartina densiflora* Brongn. | Magnoliophyta | Liliopsida | Poales | Poaceae |
| *Spartina patens* (Aiton) Muhl. | Magnoliophyta | Liliopsida | Poales | Poaceae |
| **MACROALGAE** | | | | |
| **Scientific Name** | **Phylum** | **Class** | **Order** | **Family** |
| *Agarophyton vermiculophyllum* (Ohmi) Gurgel, J.N.Norris et Fredericq | Rhodophyta | Florideophyceae | Gigartinales | Gracilariaceae |
| *Anotrichium furcellatum* (J.Agardh) Baldock | Rhodophyta | Florideophyceae | Ceramiales | Wrangeliaceae |
| *Antithamnion amphigeneum* A. Millar | Rhodophyta | Florideophyceae | Ceramiales | Ceramiaceae |
| *Antithamnion densum* (Suhr) M. Howe | Rhodophyta | Florideophyceae | Ceramiales | Ceramiaceae |
| *Antithamnion hubbsii* E.Y.Dawson | Rhodophyta | Florideophyceae | Ceramiales | Ceramiaceae |
| *Antithamnionella spirographidis* (Schiffner) E.M.Wollaston | Rhodophyta | Florideophyceae | Ceramiales | Ceramiaceae |
| *Antithamnionella ternifolia* (J.D.Hooker & Harvey) Lyle | Rhodophyta | Florideophyceae | Ceramiales | Ceramiaceae |
| *Asparagopsis armata* Harvey | Rhodophyta | Florideophyceae | Nemaliales | Bonnemaisoniaceae |
| *Codium fragile* subsp. *fragile* (Suringar) Hariot | Chlorophyta | Ulvophyceae | Bryopsidales | Codiaceae |
| *Colpomenia peregrina* Sauvageau | Ochrophyta | Phaeophyceae | Scytosiphonales | Scytosiphonaceae |
| *Dasya sessilis* Yamada | Rhodophyta | Florideophyceae | Ceramiales | Dasyaceae |
| *Grateloupia filicina* (J.V.Lamouroux) C.Agardh | Rhodophyta | Florideophyceae | Halymeniales | Halymeniaceae |
| *Hypnea musciformis* (Wulfen) J.V.Lamouroux | Rhodophyta | Florideophyceae | Gigartinales | Cystocloniaceae |
| *Sargassum muticum* (Yendo) Fensholt | Ochrophyta | Phaeophyceae | Fucales | Sargassaceae |
| *Symphyocladia marchantioides* (Harvey) Falkenberg | Rhodophyta | Florideophyceae | Ceramiales | Rhodomelaceae |

| FUNGI | | | | |
|---|---|---|---|---|
| **Scientific Name** | **Phylum** | **Class** | **Order** | **Family** |
| *Aphanomyces astaci* Schikora | Oomycota | Oomycetes | Saprolegniales | Leptolegniaceae |
| *Batrachochytrium dendrobatidis* Longcore, Pessier & D.K. Nichols | Chytridiomy-cota | Chytridiomycetes | Rhizophydiales | Incertae sedis |

American mink (*Neovison vison*) © Charles J. Homler. CC BY-NC

# Appendix B

**List of aquatic alien species with a status of uncertain or cryptogenic in Iberian inland waters**

List of introduced taxa that have been recorded in the Iberian inland waters but are not clearly established or naturalised (i.e. taxa with self-sustaining populations in the wild) (status = **uncertain**). It also includes dubious introductions of taxa catalogued as **cryptogenic** with unknown biogeographical history which cannot be ascribed as being native or alien in Iberian waters or with contested origin. More information about taxa (synonyms, native geographic range, inclusion in IAS Regulation and key literatura references) is included in the supplementary database (http://www.ibermis.org/) (http://www.lifeinvasaqua.com/).

| VERTEBRATES | | | | | |
|---|---|---|---|---|---|
| **Scientific Name** | **Phylum** | **Class** | **Order** | **Family** | **Status** |
| *Acipenser baerii* Brandt, 1869 | Chordata | Actinopterygii | Acipenseriformes | Acipenseridae | Uncertain |
| *Acipenser naccarii* Bonaparte, 1836 | Chordata | Actinopterygii | Acipenseriformes | Acipenseridae | Uncertain |
| *Aix galericulata* (Linnaeus, 1758) | Chordata | Aves | Anseriformes | Anatidae | Uncertain |
| *Anser indicus* (Latham, 1790) | Chordata | Aves | Anseriformes | Anatidae | Uncertain |
| *Apalone ferox* (Schneider, 1783) | Chordata | Reptilia | Testudines | Trionychidae | Uncertain |
| *Aphanius fasciatus* (Valenciennes, 1821) | Chordata | Actinopterygii | Cyprinodontiformes | Cyprinodontidae | Uncertain |
| *Branta canadensis* (Linnaeus, 1758) | Chordata | Aves | Anseriformes | Anatidae | Uncertain |
| *Cairina moschata* (Linnaeus, 1758) | Chordata | Aves | Anseriformes | Anatidae | Uncertain |
| *Chelydra serpentina* (Linnaeus, 1758) | Chordata | Reptilia | Testudines | Chelydridae | Uncertain |
| *Chrysemys picta* (Schneider, 1783) | Chordata | Reptilia | Testudines | Emydidae | Uncertain |
| *Cygnus atratus* (Latham, 1790) | Chordata | Aves | Anseriformes | Anatidae | Uncertain |
| *Cynops pyrrhogaster* (Boie, 1826) | Chordata | Amphibia | Caudata | Salamandridae | Uncertain |
| *Graptemys geographica* (Le Sueur, 1817) | Chordata | Reptilia | Testudines | Emydidae | Uncertain |
| *Graptemys ouachitensis* (Cagle, 1953) | Chordata | Reptilia | Testudines | Emydidae | Uncertain |
| *Graptemys pseudogeographica* (Gray, 1831) | Chordata | Reptilia | Testudines | Emydidae | Uncertain |
| *Hucho hucho* (Linnaeus, 1758) | Chordata | Actinopterygii | Salmoniformes | Salmonidae | Uncertain |
| *Leuciscus idus* (Linnaeus, 1758) | Chordata | Actinopterygii | Cypriniformes | Cyprinidae | Uncertain |
| *Lithobates catesbeianus* (Shaw, 1802) | Chordata | Amphibia | Anura | Ranidae | Uncertain |
| *Mauremys mutica* (Cantor, 1834) | Chordata | Reptilia | Testudines | Geoemydidae | Uncertain |
| *Mauremys reevesii* (Gray, 1831) | Chordata | Reptilia | Testudines | Geoemydidae | Uncertain |
| *Mauremys sinensis* (Gray, 1834) | Chordata | Reptilia | Testudines | Geoemydidae | Uncertain |
| *Mustela lutreola* (Linnaeus, 1761) | Chordata | Mammalia | Carnivora | Mustelidae | Cryptogenic |
| *Ommatotriton* spp. *(hybrids)* Gray, 1850 | Chordata | Amphibia | Caudata | Salamandridae | Uncertain |
| *Oncorhynchus aguabonita* (Jordan, 1892) | Chordata | Actinopterygii | Salmoniformes | Salmonidae | Uncertain |
| *Oncorhynchus kisutch* (Walbaum, 1792) | Chordata | Actinopterygii | Salmoniformes | Salmonidae | Uncertain |
| *Oxyura jamaicensis* (Gmelin,1789) | Chordata | Aves | Anseriformes | Anatidae | Uncertain |
| *Paramisgurnus dabryanus* Dabry de Thiersant, 1872 | Chordata | Actinopterygii | Cypriniformes | Cobitidae | Uncertain |
| *Pelodiscus sinensis* Wiegmann, 1835 | Chordata | Reptilia | Testudines | Trionychidae | Uncertain |
| *Phoxinus* sp1 | Chordata | Actinopterygii | Cypriniformes | Cyprinidae | Uncertain |
| *Poecilia reticulata* Peters, 1859 | Chordata | Actinopterygii | Cyprinodontiformes | Poeciliidae | Uncertain |
| *Pseudemys concinna* (Le Conte, 1830) | Chordata | Reptilia | Testudines | Emydidae | Uncertain |
| *Pseudemys nelsoni* Carr, 1938 | Chordata | Reptilia | Testudines | Emydidae | Uncertain |
| *Sclerophrys mauritanica* (Schlegel, 1841) | Chordata | Amphibia | Anura | Bufonidae | Uncertain |
| *Threskiornis aethiopicus* (Latham, 1790) | Chordata | Aves | Pelecaniformes | Threskionithidae | Uncertain |
| *Triturus anatolicus* (Wielstra & Arntzen 2016) | Chordata | Amphibia | Caudata | Salamandridae | Uncertain |

| INVERTEBRATES | | | | | |
|---|---|---|---|---|---|
| **Scientific Name** | **Phylum** | **Class** | **Order** | **Family** | **Status** |
| *Anguillicoloides crassus* (Kuwahara, Niimi & Itagaki, 1974) | Nematoda | Chromadorea | Rhabditida | Anguillicolidae | Cryptogenic |
| *Ampelisca cavicoxa* Reid, 1951 | Arthropoda | Malacostraca | Amphipoda | Ampeliscidae | Uncertain |
| *Ampelisca heterodactyla* Schellenberg, 1925 | Arthropoda | Malacostraca | Amphipoda | Ampeliscidae | Uncertain |
| *Amphibalanus eburneus* Gould 1841 | Arthropoda | Theocostraca | Sessilia | Balanidae | Uncertain |
| *Aplus assimilis* (Reeve, 1846) | Mollusca | Gastropoda | Neogastropoda | Pisaniidae | Uncertain |
| *Astacus astacus* (Linnaeus, 1758) | Arthropoda | Malacostraca | Decapoda | Astacidae | Uncertain |
| *Austropotamobius italicus* (Faxon, 1914) | Arthropoda | Malacostraca | Decapoda | Astacidae | Cryptogenic |
| *Boccardia proboscidea* Hartman, 1940 | Annelida | Polychaeta | Spionida | Spionidae | Uncertain |
| *Boccardia semibranchiata* Guérin, 1990 | Annelida | Polychaeta | Spionida | Spionidae | Uncertain |
| *Botrylloides violaceus* Oka, 1927 | Chordata | Ascidiacea | Stolidobranchia | Styelidae | Uncertain |
| *Brachidontes pharaonis* (Fischer, 1870) | Mollusca | Bivalvia | Mytilida | Mytilidae | Uncertain |
| *Branchiomma boholense* (Grube, 1878) | Annelida | Polychaeta | Sabellida | Sabellidae | Uncertain |
| *Caprella mutica* Schurin, 1935 | Arthropoda | Malacostraca | Amphipoda | Caprellidae | Uncertain |
| *Caprella scaura* Templeton, 1836 | Arthropoda | Malacostraca | Amphipoda | Caprellidae | Uncertain |
| *Cerithium scabridum* Philippi, 1848 | Mollusca | Gastropoda | Unassigned | Cerithiidae | Uncertain |
| *Cipangopaludina chinensis* (Gray in Griffith & Pidgeon, 1833) | Mollusca | Gastropoda | Architaenioglossa | Viviparidae | Uncertain |
| *Corophium orientale* Schellenberg, 1928 | Arthropoda | Malacostraca | Amphipoda | Corophiidae | Uncertain |
| *Dyspanopeus sayi* (S. I. Smith, 1869) | Arthropoda | Malacostraca | Decapoda | Panopeidae | Uncertain |
| *Eocuma dimorphum* Fage, 1928 | Arthropoda | Malacostraca | Cumacea | Bodotriidae | Uncertain |
| *Fulvia fragilis* (Forsskål in Niebuhr, 1775) | Mollusca | Bivalvia | Cardiida | Cardiidae | Uncertain |
| *Galba cubensis* (L. Pfeiffer, 1839) | Mollusca | Gastropoda | Unassigned | Lymnaeidae | Uncertain |
| *Galba schirazensis* (Küster, 1862) | Mollusca | Gastropoda | Unassigned | Lymnaeidae | Uncertain |
| *Gonionemus vertens* Agassiz, 1862 | Cnidaria | Hydrozoa | Limnomedusae | Olindiidae | Uncertain |
| *Haloa japonica* (Pilsbry, 1895) | Mollusca | Gastropoda | Cephalaspidea | Haminoeidae | Uncertain |
| *Hellobdella octatestisaca* Lai & Chang 2009 | Annelida | Clitellata | Rhynchobdellida | Glossiphoniidae | Uncertain |
| *Helobdella europaea* Kutschera, 1987 | Annelida | Clitellata | Rhynchobdellida | Glossiphoniidae | Uncertain |
| *Hemigrapsus takanoi* Asakura & Watanabe, 2005 | Arthropoda | Malacostraca | Decapoda | Varunidae | Uncertain |
| *Hexapleomera robusta* (Moore, 1894) | Arthropoda | Malacostraca | Tanaidacea | Tanaididae | Uncertain |
| *Hydroides elegans* (Haswell, 1883) | Annelida | Polychaeta | Sabellida | Serpulidae | Uncertain |
| *Mercenaria mercenaria* (Linnaeus, 1758) | Mollusca | Bivalvia | Venerida | Veneridae | Uncertain |
| *Molgula manhattensis* (De Kay, 1843) | Chordata | Ascidiacea | Stolidobranchia | Molgulidae | Uncertain |
| *Monocorophium acherusicum* (Costa, 1853) | Arthropoda | Malacostraca | Amphipoda | Corophiidae | Uncertain |
| *Mytilicola orientalis* Mori, 1935 | Arthropoda | Hexanauplia | Cyclopoida | Mytilicolidae | Uncertain |
| *Neopolystoma* spp. Price, 1939 | Platyhelminthes | Monogenea | Polystomatidea | Polystomatidae | Uncertain |
| *Paracerceis sculpta* (Holmes, 1904) | Arthropoda | Malacostraca | Isopoda | Sphaeromatidae | Uncertain |
| *Paradella dianae* (Menzies, 1962) | Arthropoda | Malacostraca | Isopoda | Sphaeromatidae | Uncertain |
| *Pectinatella magnifica* (Leidy, 1851) | Bryozoa | Phylactolaemata | Plumatellida | Pectinatellidae | Uncertain |
| *Penaeus japonicus* Spence Bate, 1888 | Arthropoda | Malacostraca | Decapoda | Penaeidae | Uncertain |
| *Penaeus monodon* Fabricius, 1798 | Arthropoda | Malacostraca | Decapoda | Penaeidae | Uncertain |
| *Perinereis linea* (Treadwell, 1936) | Annelida | Polychaeta | Phyllodocida | Nereididae | Uncertain |
| *Philometra ovata* (Zeder, 1803) | Nematoda | Secernentea | Camallanida | Philometridae | Uncertain |
| *Physella gyrina* (Say, 1821) | Mollusca | Gastropoda | Unassigned | Physidae | Cryptogenic |
| *Polycerella emertoni* A.E.Verrill, 1880 | Mollusca | Gastropoda | Nudibranchia | Polyceridae | Uncertain |
| *Rapana venosa* (Valenciennes, 1846) | Mollusca | Gastropoda | Neogastropoda | Muricidae | Uncertain |
| *Sarscypridopsis lanzarotensis* (Mallwitz, 1984) | Arthropoda | Ostracoda | Podocopida | Cyprididae | Cryptogenic |
| *Serejohyale spinidactylus* (Chevreux, 1926) | Arthropoda | Malacostraca | Amphipoda | Hyalidae | Uncertain |
| *Tanycypris* spp.Triebel, 1959 | Arthropoda | Ostracoda | Podocopida | Cyprididae | Uncertain |
| *Tonicia atrata* (G. B. Sowerby II, 1840) | Mollusca | Polyplacophora | Chitonida | Chitonidae | Uncertain |
| *Victorella pavida* Saville-Kent, 1870 | Bryozoa | Gymnolaemata | Ctenostomatida | Victorellidae | Uncertain |

| PLANTS | | | | | |
|---|---|---|---|---|---|
| **Scientific Name** | **Phylum** | **Class** | **Order** | **Family** | **Status** |
| *Blyxa japonica* (Miq.) Maxim. ex Asch. & Gürke | Magnoliophyta | Liliopsida | Alismatales | Hydrocharitaceae | Uncertain |
| *Crassula aquatica* (L.) Schönland | Magnoliophyta | Magnoliopsida | Saxifragales | Crassulaceae | Uncertain |
| *Hydrocotyle ranunculoides* L. fil. | Magnoliophyta | Magnoliopsida | Apiales | Apiaceae | Uncertain |
| *Potamogeton schweinfurthii* A.Benn | Magnoliophyta | Liliopsida | Alismatales | Potamogetonaceae | Cryptogenic |
| *Rotala indica* (Willd.) Koehne | Magnoliophyta | Magnoliopsida | Myrtales | Lythraceae | Uncertain |
| *Sagittaria calycina* Engelm. | Magnoliophyta | Liliopsida | Alismatales | Alismataceae | Uncertain |
| *Salvinia natans* (L.) All | Pteridophyta | Polypodiopsida | Salviniales | Salviniaceae | Cryptogenic |
| *Salvinia molesta* D.S. Mitch. | Pteridophyta | Polypodiopsida | Salviniales | Salviniaceae | Uncertain |
| **MACROALGAE** | | | | | |
| **Scientific Name** | **Phylum** | **Class** | **Order** | **Family** | **Status** |
| *Asparagopsis taxiformis* (Delile) Trevisan | Rhodophyta | Florideophyceae | Nemaliales | Bonnemaisoniaceae | Uncertain |
| *Bonnemaisonia hamifera* Hariot | Rhodophyta | Florideophyceae | Nemaliales | Bonnemaisoniaceae | Uncertain |
| *Caulerpa racemosa* (Forsskål) J.Agardh | Chlorophyta | Ulvophyceae | Bryopsidales | Caulerpaceae | Uncertain |
| *Centroceras clavulatum* (C.Agardh) Montagne | Rhodophyta | Florideophyceae | Ceramiales | Ceramiaceae | Cryptogenic |
| *Ceramium secundatum* Lyngbye | Rhodophyta | Florideophyceae | Ceramiales | Ceramiaceae | Uncertain |
| *Grateloupia subpectinata* Holmes | Rhodophyta | Florideophyceae | Halymeniales | Halymeniaceae | Uncertain |
| *Lomentaria hakodatensis* Yendo | Rhodophyta | Florideophyceae | Rhodymeniales | Lomentariaceae | Uncertain |
| *Melanothamnus harveyi* (Bailey) Díaz-Tapia & Maggs | Rhodophyta | Florideophyceae | Ceramiales | Rhodomelaceae | Uncertain |
| *Neosiphonia harveyi* M.-S.Kim, H.-G.Choi, Guiry & G.W.Saunders | Rhodophyta | Florideophyceae | Ceramiales | Rhodomelaceae | Uncertain |
| *Rugulopteryx okamura* (E.Y.Dawson) I.K.Hwang, W.J.Lee & H.S.Kim | Ochrophyta | Phaeophyceae | Dictyotales | Dictyotaceae | Uncertain |
| *Ulva australis* Areschoug | Chlorophyta | Ulvophyceae | Ulvales | Ulvaceae | Uncertain |
| *Undaria pinnatifida* (Harvey) Suringar | Ochrophyta | Phaeophyceae | Laminariales | Alariaceae | Uncertain |
| *Womersleyella setacea* (Hollenberg) R.E.Norris | Rhodophyta | Florideophyceae | Ceramiales | Rhodomelaceae | Uncertain |
| **FUNGI** | | | | | |
| **Scientific Name** | **Phylum** | **Class** | **Order** | **Family** | **Status** |
| *Aphanomyces frigidophilus* Kitanch. & Hatai | Oomycota | Oomycetes | Saprolegniales | Leptolegniaceae | Cryptogenic |

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# Appendix C

## Number of aquatic alien species defined by taxonomic groups (Phyla, Class and Order)

| | Phylum | Class | Order | Total | Established | Uncertain | Cryptogenic |
|---|---|---|---|---|---|---|---|
| VERTEBRATES | **Chordata** | | | **76** | **41** | **34** | **1** |
| | | **Actinopterygii** | | **42** | **32** | **10** | **0** |
| | | | Acipenseriformes | 2 | 0 | 2 | 0 |
| | | | Cypriniformes | 19 | 16 | 3 | 0 |
| | | | Cyprinodontiformes | 5 | 3 | 2 | 0 |
| | | | Esociformes | 1 | 1 | 0 | 0 |
| | | | Perciformes | 6 | 6 | 0 | 0 |
| | | | Salmoniformes | 6 | 3 | 3 | 0 |
| | | | Siluriformes | 3 | 3 | 0 | 0 |
| | | **Amphibia** | | **8** | **3** | **5** | **0** |
| | | | Anura | 5 | 3 | 2 | 0 |
| | | | Caudata | 3 | 0 | 3 | 0 |
| | | **Reptilia** | | **13** | **1** | **12** | **0** |
| | | | Testudines | 13 | 1 | 12 | 0 |
| | | **Aves** | | **8** | **1** | **7** | **0** |
| | | | Anseriformes | 7 | 1 | 6 | 0 |
| | | | Pelecaniformes | 1 | 0 | 1 | 0 |
| | | **Mammalia** | | **5** | **4** | **0** | **1** |
| | | | Carnivora | 3 | 2 | 0 | 1 |
| | | | Rodentia | 2 | 2 | 0 | 0 |

| | Phylum | Class | Order | Total | Established | Uncertain | Cryptogenic |
|---|---|---|---|---|---|---|---|
| INVERTEBRATES | **Chordata** | | | **8** | **6** | **2** | **0** |
| | | **Ascidiacea** | | **8** | **6** | **2** | **0** |
| | | | Aplousobranchia | 1 | 1 | 0 | 0 |
| | | | Phlebobranchia | 1 | 1 | 0 | 0 |
| | | | Stolidobranchia | 6 | 4 | 2 | 0 |
| | **Annelida** | | | **14** | **7** | **7** | **0** |
| | | **Clitellata** | | **5** | **3** | **2** | **0** |
| | | | Branchiobdellida | 1 | 1 | 0 | 0 |
| | | | Euhirudinea | 1 | 1 | 0 | 0 |
| | | | Haplotaxida | 1 | 1 | 0 | 0 |
| | | | Rhynchobdellida | 2 | 0 | 2 | 0 |
| | | **Polychaeta** | | **9** | **4** | **5** | **0** |
| | | | Phyllodocida | 1 | 0 | 1 | 0 |
| | | | Sabellida | 4 | 2 | 2 | 0 |
| | | | Spionida | 4 | 2 | 2 | 0 |
| | **Arthropoda** | | | **67** | **45** | **20** | **2** |
| | | **Branchipoda** | | **3** | **3** | **0** | **0** |
| | | | Anostraca | 1 | 1 | 0 | 0 |
| | | | Diplostraca | 2 | 2 | 0 | 0 |
| | | **Hexanauplia** | | **4** | **3** | **1** | **0** |
| | | | Calanoida | 2 | 2 | 0 | 0 |
| | | | Cyclopoida | 2 | 1 | 1 | 0 |
| | | **Ichthyostraca** | | **1** | **1** | **0** | **0** |
| | | | Arguloida | 1 | 1 | 0 | 0 |
| | | **Insecta** | | **5** | **5** | **0** | **0** |
| | | | Coleoptera | 1 | 1 | 0 | 0 |
| | | | Diptera | 3 | 3 | 0 | 0 |
| | | | Hemiptera | 1 | 1 | 0 | 0 |
| | | **Malacostraca** | | **30** | **12** | **17** | **1** |
| | | | Amphipoda | 9 | 1 | 8 | 0 |
| | | | Cumacea | 1 | 0 | 1 | 0 |
| | | | Decapoda | 16 | 10 | 5 | 1 |
| | | | Isopoda | 3 | 1 | 2 | 0 |
| | | | Tanaidacea | 1 | 0 | 1 | 0 |
| | | **Ostracoda** | | **19** | **17** | **1** | **1** |
| | | | Podocopida | 19 | 17 | 1 | 1 |
| | | **Theocostraca** | | **5** | **4** | **1** | **0** |
| | | | Sessilia | 5 | 4 | 1 | 0 |
| | **Bryozoa** | | | **7** | **5** | **2** | **0** |
| | | **Gymnolaemata** | | **6** | **5** | **1** | **0** |
| | | | Cheilostomatida | 5 | 5 | 0 | 0 |
| | | | Ctenostomatida | 1 | 0 | 1 | 0 |
| | | **Phylactolaemata** | | **1** | **0** | **1** | **0** |
| | | | Plumatellida | 1 | 0 | 1 | 0 |
| | **Cnidaria** | | | **6** | **5** | **1** | **0** |
| | | **Anthozoa** | | **1** | **1** | **0** | **0** |
| | | | Actiniaria | 1 | 1 | 0 | 0 |
| | | **Hydrozoa** | | **5** | **4** | **1** | **0** |
| | | | Anthoathecata | 1 | 1 | 0 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| INVERTEBRATES | | | Leptothecata | 1 | 1 | 0 | 0 |
| | | | Limnomedusae | 3 | 2 | 1 | 0 |
| | **Ctenophora** | | | **1** | **1** | **0** | **0** |
| | | **Tentaculata** | | **1** | **1** | **0** | **0** |
| | | | Lobata | 1 | 1 | 0 | 0 |
| | **Mollusca** | | | **42** | **29** | **12** | **1** |
| | | **Bivalvia** | | **16** | **13** | **3** | **0** |
| | | | Adapedonta | 1 | 1 | 0 | 0 |
| | | | Arcida | 2 | 2 | 0 | 0 |
| | | | Cardiida | 1 | 0 | 1 | 0 |
| | | | Myida | 3 | 3 | 0 | 0 |
| | | | Mytilida | 3 | 2 | 1 | 0 |
| | | | Ostreida | 2 | 2 | 0 | 0 |
| | | | Unionida | 1 | 1 | 0 | 0 |
| | | | Venerida | 3 | 2 | 1 | 0 |
| | | **Gastropoda** | | **24** | **16** | **7** | **1** |
| | | | (unassigned) | 7 | 3 | 3 | 1 |
| | | | Aplysiida | 1 | 1 | 0 | 0 |
| | | | Architaenioglossa | 4 | 3 | 1 | 0 |
| | | | Basommatophora | 4 | 4 | 0 | 0 |
| | | | Cephalaspidea | 1 | 0 | 1 | 0 |
| | | | Littorinimorpha | 3 | 3 | 0 | 0 |
| | | | Neogastropoda | 2 | 1 | 1 | 0 |
| | | | Neotaenioglossa | 1 | 1 | 0 | 0 |
| | | | Nudibranchia | 1 | 0 | 1 | 0 |
| | | **Polyplacophora** | | **1** | **0** | **1** | **0** |
| | | | Chitonida | 1 | 0 | 1 | 0 |
| | **Nematoda** | | | **2** | **0** | **1** | **1** |
| | | **Chromadorea** | | **1** | **0** | **0** | **1** |
| | | | Rhabditida | 1 | 0 | 0 | 1 |
| | | **Secernentea** | | **1** | **0** | **1** | **0** |
| | | | Camallanida | 1 | 0 | 1 | 0 |
| | **Platyhelmin-thes** | | | **18** | **17** | **1** | **0** |
| | | **Cestoda** | | **1** | **1** | **0** | **0** |
| | | | Bothriocephalidea | 1 | 1 | 0 | 0 |
| | | **Monogenea** | | **11** | **10** | **1** | **0** |
| | | | Dactylogyridea | 5 | 5 | 0 | 0 |
| | | | Gyrodactylidea | 3 | 3 | 0 | 0 |
| | | | Polyopisthocotylea | 2 | 2 | 0 | 0 |
| | | | Polystomatidea | 1 | 0 | 1 | 0 |
| | | **Rhabditophora** | | **2** | **2** | **0** | **0** |
| | | | Tricladida | 2 | 2 | 0 | 0 |
| | | **Trematoda** | | **4** | **4** | **0** | **0** |
| | | | Diplostomida | 2 | 2 | 0 | 0 |
| | | | Plagiorchiida | 2 | 2 | 0 | 0 |

| | Phylum | Class | Order | Total | Established | Uncertain | Cryptogenic |
|---|---|---|---|---|---|---|---|
| PLANTS | **Magnoliophyta** | | | **32** | **26** | **5** | **1** |
| | | **Liliopsida** | | **19** | **16** | **2** | **1** |
| | | | Alismatales | 12 | 9 | 2 | 1 |
| | | | Commelinales | 4 | 4 | 0 | 0 |
| | | | Poales | 3 | 3 | 0 | 0 |
| | | **Magnoliopsida** | | **13** | **10** | **3** | **0** |
| | | | Apiales | 3 | 2 | 1 | 0 |
| | | | Caryophyllales | 1 | 1 | 0 | 0 |
| | | | Lamiales | 1 | 1 | 0 | 0 |
| | | | Myrtales | 4 | 3 | 1 | 0 |
| | | | Nymphaeales | 1 | 1 | 0 | 0 |
| | | | Saxifragales | 3 | 2 | 1 | 0 |
| | **Pteridophyta** | | | **3** | **1** | **1** | **1** |
| | | **Polypodiopsida** | | **3** | **1** | **1** | **1** |
| | | | Salviniales | 3 | 1 | 1 | 1 |
| MACROALGAE | **Chlorophyta** | | | **3** | **1** | **2** | **0** |
| | | **Ulvophyceae** | | **1** | **1** | **0** | **0** |
| | | | Bryopsidales | 2 | 1 | 1 | 0 |
| | | | Ulvales | 1 | 0 | 1 | 0 |
| | **Ochrophyta** | | | **4** | **2** | **2** | **0** |
| | | **Phaeophyceae** | | **4** | **2** | **2** | **0** |
| | | | Dictyotales | 1 | 0 | 1 | 0 |
| | | | Laminariales | 1 | 0 | 1 | 0 |
| | | | Scytosiphonales | 1 | 1 | 0 | 0 |
| | | | Fucales | 1 | 1 | 0 | 0 |
| | **Rhodophyta** | | | **21** | **12** | **8** | **1** |
| | | **Florideophyceae** | | **21** | **12** | **8** | **1** |
| | | | Ceramiales | 12 | 8 | 3 | 1 |
| | | | Gigartinales | 3 | 2 | 1 | 0 |
| | | | Halymeniales | 2 | 1 | 1 | 0 |
| | | | Nemaliales | 3 | 1 | 2 | 0 |
| | | | Rhodymeniales | 1 | 0 | 1 | 0 |
| FUNGI | **Oomycota** | | | **2** | **1** | **0** | **1** |
| | | **Oomycetes** | | **2** | **1** | **0** | **1** |
| | | | Saprolegniales | 2 | 1 | 0 | 1 |
| | **Chytridiomycota** | | | **1** | **1** | **0** | **0** |
| | | **Chytridiomycetes** | | **1** | **1** | **0** | **0** |
| | | | Rhizophydiales | 1 | 1 | 0 | 0 |

Blue crab (*Callinectes sapidus*) © Javier Murcia Requena


LIFE INVASAQUA

**Abstract**

An updated list is presented of the alien species in the establishment or spread invasion stage in inland waters at the Iberian Peninsula. The list is based on a systematic assessment of information in collaboration with a wide expert team from Spain and Portugal. This updated list is an important tool supporting the implementation of the EU Regulation of Invasive Alien Species (IAS) and provides a factual basis for the review of its application. Ultimately, the included information can be used for monitoring the achievement of the target of the EU Biodiversity Strategy for 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.

## 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**

UNIVERSIDAD DE MURCIA

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