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

Updated list of potential aquatic alien species with high risk of invasion in Iberian inland waters





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Cane Toad (*Rhinella marina*).

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Authors

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LIFE INVASAQUA – TECHNICAL REPORT

Senegal Tea Plant (*Gymnocoronis spilanthoides*) © John Tann. CC BY 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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LIFE INVASAQUA and IUCN-Med developed a website portal IBERMIS where technical reports and supplementary data are freely available (http://www.ibermis.org/).

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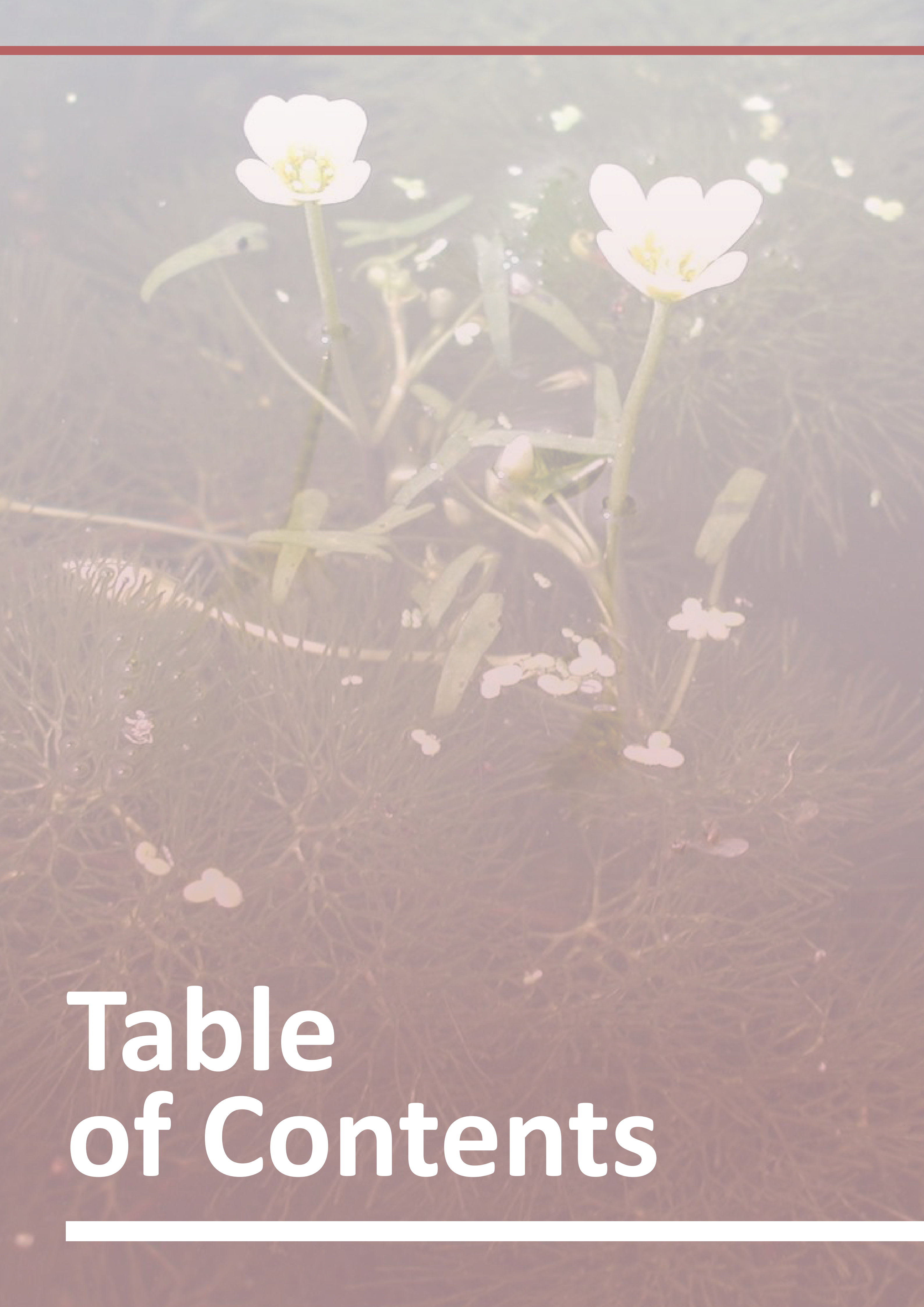
Abstract:
An updated list is presented of the alien species in the transport or introduction invasion stage in inland waters of the Iberian Peninsula. The list is based on a systematic assessment of information in collaboration with a wide expert team from Spain and Portugal. This list is an important tool to support the implementation of the IAS Regulation, particularly in prevention measures and in the development of an Early Warning and Rapid Response (EWRR) system. Ultimately, the information included can help to 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 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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The national competent authority of Spain (Ministerio para la Transición Ecológica y el Reto Demográfico, MITERD) supported the compilation by providing the inventory on alien species included in the List of non-native species capable of competing with native wild species, altering their genetic purity or ecological balances involved in the R.D. 570/2020.

Snakehead (*Channa argus*) © Brian Gratwicke. CC BY 2.0

Acronyms and short-names

AIL – Iberian Society of Limnology

CABI-ISC – Centre of Agriculture and Biosciences International - Invasive Species Compendium

CIREF – Iberian Centre of Fluvial Restoration

EASIN – European Alien Species Information Network

EU – European Union

EWRR – Early Warning and Rapid Response framework

GISD – Global Invasive Species Database

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 changes in ecosystem services and are 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 Potential Aquatic Alien Species of the Iberian Peninsula (hereafter referred to as List) is an inventory of the alien species not yet present in the Iberian inland waters, but included in the transport or in the introduction stage of the invasion process.

Scope

The listed alien aquatic biota was divided into five main groups: vertebrates, invertebrates, plants, macroalgae and fungi. The main objective was to develop a checklist by systematically listing alien species not yet recorded in inland waters to assess both its invasiveness and also the risk of invasion, and thus define their status as potential taxa.

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 team of 60 experts to identify issues, agree on methodologies and progress by consensus. The assessment was compiled based on data and knowledge from the experts who represent a large biological invasions expertise in different taxa and bioma types and have a long track record in interaction science and management.

A structured step-approach was followed 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 between January 2019 and October 2020. The assessment was a shared process with an updated inventory of the alien species that are already recorded in the Iberian inland waters.

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

Results

A total of 272 alien taxa were identified as potential invaders to the Iberian inland waters. The high risk of invasion is either because they are involved in transport or in an introduction stage of the invasion process.

Most of the taxa included in the List exhibit invasive behaviour and have a high impact on aquatic ecosystem services and biodiversity in other geographical regions. In fact, 85.3% of the taxa in the List are described in, at least, one of the following IAS databases: EASIN, GISD or CABI-ISC.

Chordata (46.7% of the total), followed by Arthropoda (19.1%), Magnoliophyta (14.0%), and Mollusca (9.9%) are the most listed taxa. The four groups represent 89.7% of the potential taxa (Appendix B).

Key conclusions

The resulting List is an important tool to support the implementation of the IAS Regulation, mainly in the EWRR framework, 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 not yet present in the territory and can foster trans-national cooperation and coordination across borders or within shared biogeographical regions. This updated information of potential IAS will also help Spain and Portugal, and the EU, in establishing new prevention actions to be undertaken by the competent authorities when 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.

Senegal Tea Plant (*Gymnocoronis spilanthoides*) © Krzysztof Ziarnek, Kenraiz. CC BY-SA 4.0

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 awareness, 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 the 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 services 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 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, as 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 EWRR, to ensure a prompt eradication of localised IAS and to more efficiently manage the IAS that are established (Genovesi et al. 2015, Reaser et al. 2020). In this management framework, developing lists of potential taxa with high risk of invasion any MS of the EU (also in any biogeographical area), as well as other information such as region of origin 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).

Central to prevent and battle againts invasive species within the Iberian level, is the identification of alien species that are likely to become invasive. An effective response relies on being able to pinpoint those taxa which are currently absent in Iberian inland waters but are likely to enter at some future time, being some of them in captivity or cultivation but no introductions in natural habitats have not yet recorded. Those taxa can be assigned to a preliminary alarm list (or alert list) (EEA 2010).

The List of the Potential Aquatic Alien Species of the Iberian Peninsula (hereafter referred to as List) is an inventory of the alien species present in the transport or in the introduction 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 the pathways. As a first step to an alarm list developing, this List of potential alien species should be a key tool firstly for improving IAS prevention and, secondly, for prioritising management actions.

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 combating IAS, but also for implementing 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 establish a list of the alien species which are present in the transport or in the introduction invasion stage and are therefore likely to enter at some future time in the Iberian inland waters.

- To contribute to regional, national and European IAS management and control plannings providing a baseline updated list which includes valuable information, for instance, to improve its EWRR framework.

- 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 following main outputs:

- A summary report on the updated checklist of many potential aquatic alien species not yet recorded in the Iberian Peninsula with high risk of invasion by expert consensus.

- A freely available database holding the descriptive data for potential aquatic alien species defined in the transport and/or introduction invasion phase.

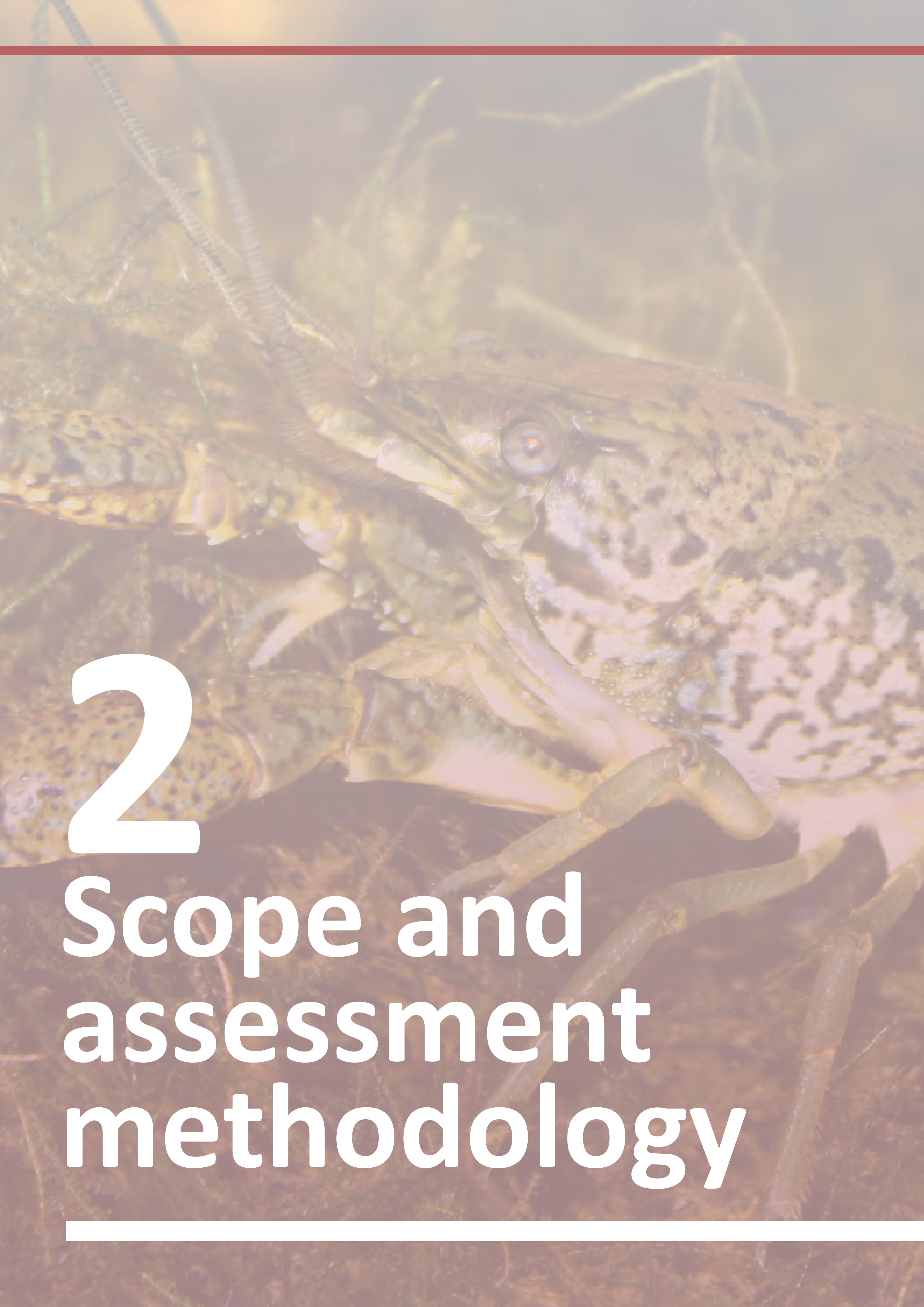
- At the same time, LIFE INVASAQUA and SIBIC have developed a list of recorded taxa and data portal of records showcasting information in the form of factsheets of most of the recorded taxa (https://eei.sibic.org/).

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 potential 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 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.

Cane Toad (*Rhinella marina*)



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 Spain and Portugal (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 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 aquatic systems in geographical areas outside Iberian Peninsula 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 evaluated the risk invasion 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 may have been included. Marine taxa (except those which can 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 evaluated the invasion stage of each alien taxa at the Iberian geographical scale as in **transport stage** or **introduction stage** (BOX 1). Moreover, their qualities of being invasive and the potential risk of establishment and spread in the Iberina inland waters were also assessed. 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 stumble to invasion failures. Moreover, an alien species could also have several populations at different stages. Therefore, reference to the invasion status at the Iberian level regarding of certain given species should be temporally explicit. Exotic taxa that are already present in the natural environments are excluded (establishment and spread stages sensu Blackburn et al. 2011). Hence, the List defines a group of taxa (status = **potential**) not yet recorded in Iberian inland waters but they are already in transport or introduction invasion stage (Richardson et al. 2010, Blackburn et al. 2011) (BOX 1). In this way, the List includes taxa involved in the world-trade of commercial species, angling and aquaculture as important pathways for IAS into Iberian inland waters (García-Berthou et al. 2007, Cobo et al. 2010, Anastácio et al. 2019, Muñoz-Mas & García-Berthou 2020).

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).

Early Warning and Rapid Response system for invasive alien species: is defined as a framework aimed at responding to biological invasions, through a coordinated system of surveillance and monitoring activities, diagnosis of invading species, assessment of risks, circulation of information, reporting to competent authorities, identification and enforcement of appropriate responses (EEA 2010).

Alert list (or Alarm list): are lists of alien species not yet present in a region, or being eventually reported in that region, that pose risks to the invaded area and for which particular surveillance and monitoring efforts are recommended, in order to enhance prompt response in the case of arrival and spread. The list shall be communicated to the competent authorities (EEA 2010).

Transport stage: in the invasion process includes taxa transported beyond limits of its native ranges (Richardson et al. 2010, Blackburn et al. 2011). The concept includes for example taxa involved in intercontinental movement into a new region primarily as a result of global commerce and trade.

Introduction stage: in the invasion process includes taxa that have been transported beyond limits of its native ranges, and are in cultivation, captivity or quarantine in a new region (Richardson et al. 2010, Blackburn et al. 2011). The concept includes for example species provided with conditions suitable for them into a new region, but explicit measures of containment or to prevent dispersal are limited.

Potential taxa: are alien species not yet present in a territory but already present in transport or introduction invasion stage, i.e. with a high risk of invasion in that territory. Most of them are IAS and, consequently, may be included in an alert list (or alarm list).

2.3. Assessment and species screening

The information on potential alien species is scattered across various sources, including scientific literature, online and offline databases, national and international 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. The assessment was a shared process with the one developed to updated the inventory of the alien species that are already recorded in the inland waters at the Iberian level (Oliva-Paterna et al. 2021).

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 solved 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 long track record 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 invasive alien knowledge with the collaborative expert identification and consolidation before mentioned.

Step 1. Systematic review and working groups composition.

Scientific literature, technical reports, IAS databases (e.g. EASIN, GISD, and CABI-ISC) and other web sources were systematically screened to obtain a preliminary list of potential alien species that were considered likely to arrive within the next decades into the Iberian estuarine and inland waters. This preliminary review was developed by the LIFE INVASAQUA project staff for a period of approximately four months.

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 and completing with alien species that were considered likely to arrive within the next years, to establish and have an impact on native biodiversity, ecosystems and/or human health. The groups were instructed to assess the preliminary list to the Iberian Peninsula, adding and removing taxa as appropriate. Over a period of six months the experts completed this initial exercise by email and web-meetings. Comparable lists generated from previous scientific studies in others geographical areas, at national or inter-national levels, were circulated to all working groups (e.g. Almeida et al. 2013, Gallardo et al. 2016, Carboneras et al. 2018, Nentwing et al. 2018, Roy et al. 2018, Peyton et al. 2019).

Step 3. Uncertainties discrimination and taxa status definition.

Experts collected additional information to assess the invasion stage and define the status as potential. 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.

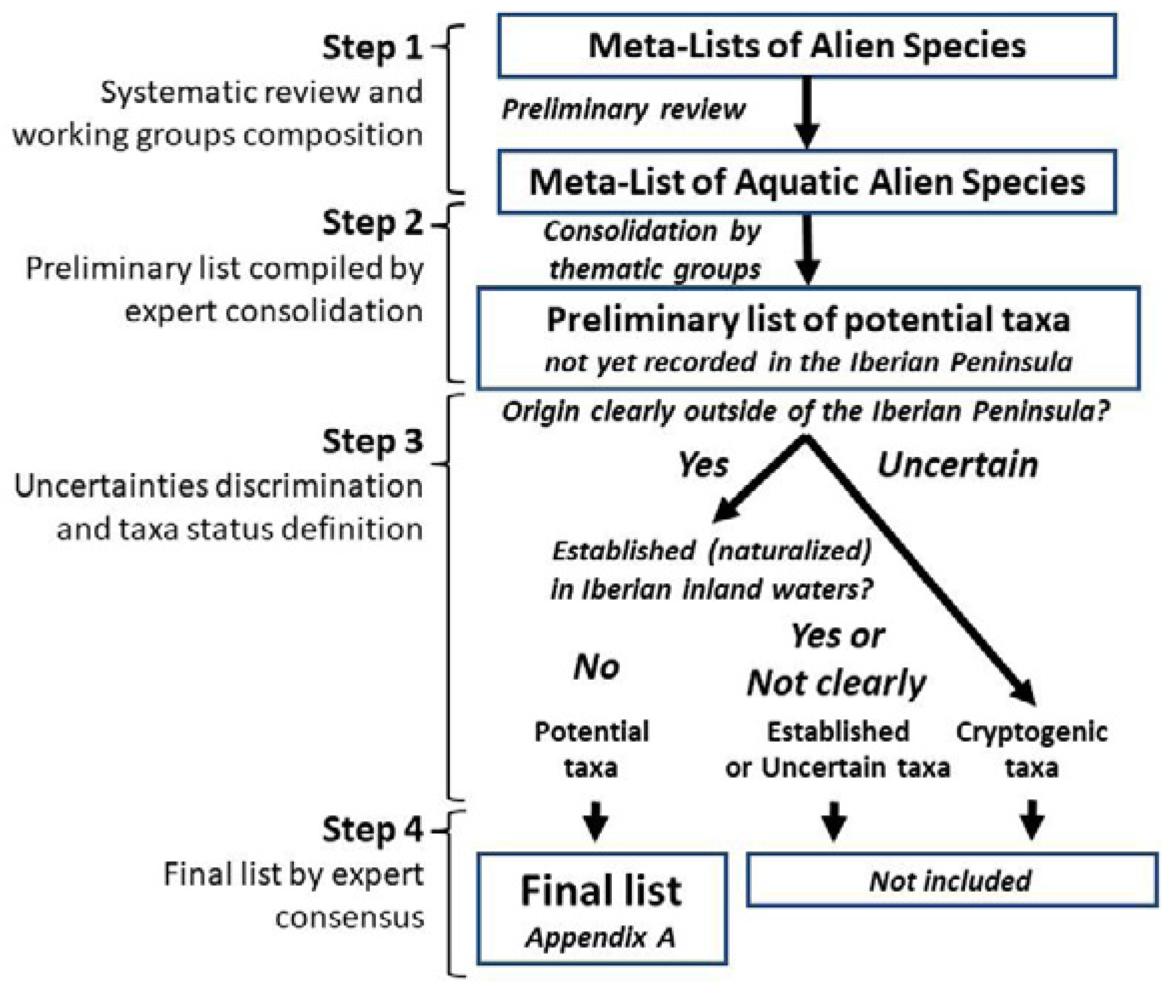
Step 4. Final list by expert consensus across the thematic groups.

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 potential status of taxa and is supported by literature and data sources. For all listed potential 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 (potential)
- Inclusion in IAS Regulation (Union List, Spanish IAS catalog, Spanish Allochthonous List, Portuguese National List of IAS) (in Supplementary database)
- Inclusion in lists obtained from key literature references (in Supplementary database)

BOX 2 – Structured step-approach of the assessment.



3 Results

3. Results

3.1. List of potential taxa

The List includes 272 potential alien species not yet recorded in the inland waters of the Iberian Peninsula but with high risk of invasion in these aquatic systems (Figure A). From that list, experts identified 121 taxa of vertebrates (44.5% of the total), 98 of invertebrates (36.0%), 41 of plants (15.1%), 11 of macroalgae (4.0%) and 1 of fungi (0.4%) (Appendix A).

The Spanish Allochthonous List, which is focused on potential taxa, reflects a 55.1% of the taxa included in the List of the present study (150 taxa). Even though it is understood that the rest of rules and regulations do not focus on potential taxa, it is important to highlight that 9 potential taxa listed are already 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 involve 9.6% (26 taxa) and 10.7% (29 taxa), respectively, of the total taxa included in the present assessment.

Furthermore, 85.3% of taxa in the List are included in, at least, one of the following IAS databases: EASIN, GISD or CABI.

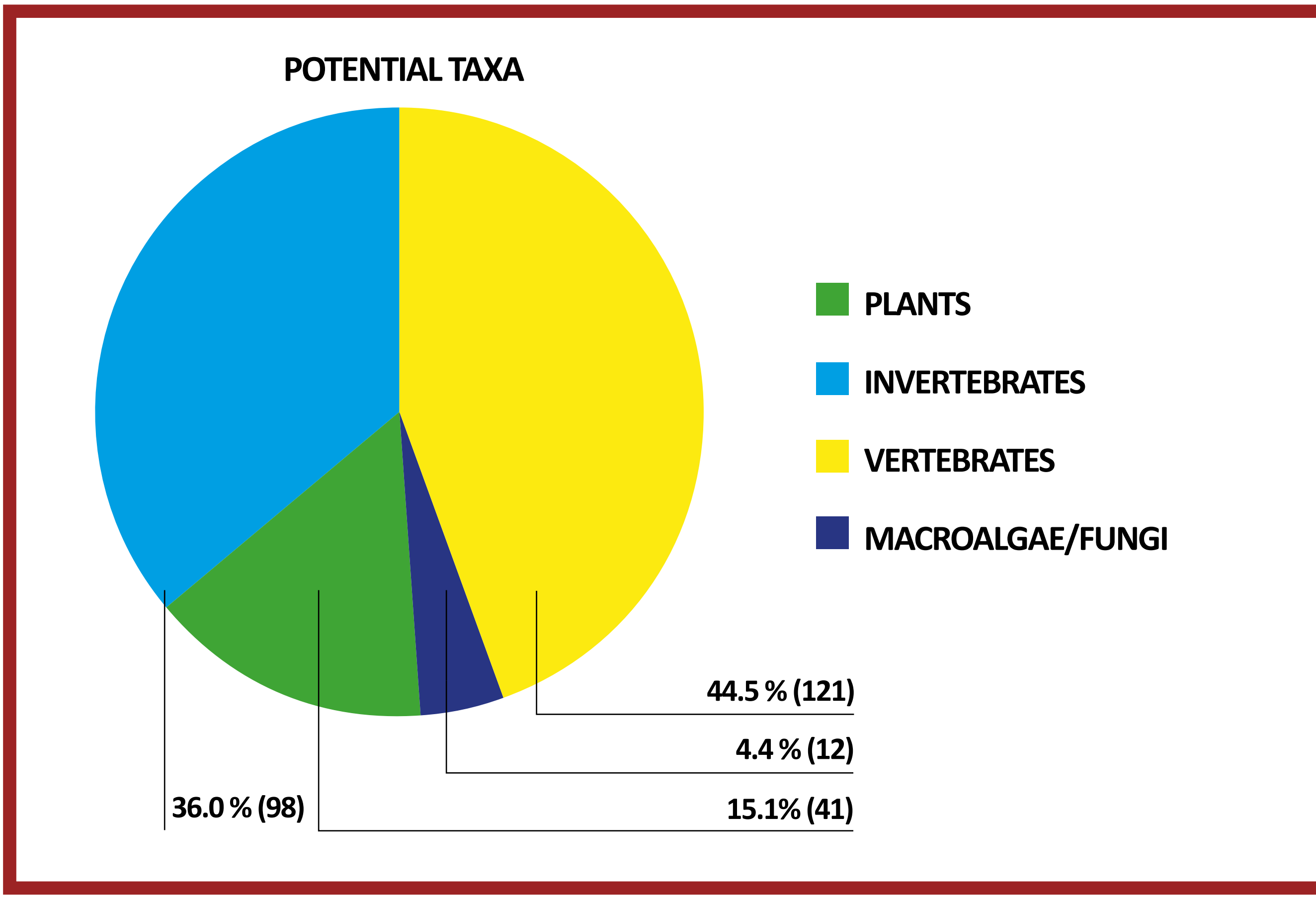


Figure A. Relative frequency (in colored pie charts) and total number (in brackets) of alien taxa defined as potential in the outcoming updated List.

3.2. Taxonomic approach

Aquatic taxa included in the List of potential taxa belong to 15 phyla divided into 30 classes. The number of species defined as potential status by phylum and class are presented in Table A (Appendix B includes the number of species also defined by orders).

The most represented taxa in the List were Chordata 46.7%, followed by Arthropoda 19.1%, Magnoliophyta 14.0%, and Mollusca 9.9% (Table A). Each group of Annelida, Cnidaria, Rhodophyta and Pteridophyta showed an approximate average between 1% and 3% of the listed species, and only a few species (less than 1%) have been reported for the rest of taxonomic groups.

Overall, Actinopterygii 33.1% (90 taxa), Malacostraca 15.4% (42 taxa), Bivalvia 5.1% (14 taxa), and Gastropoda 4.4% (12 taxa), were the classes among animals showing highest percentages of listed taxa. Moreover, Liliopsida 8.5% (23 taxa) and Magnoliopsida 5.5% (15 taxa), as main classes of Magnoliophyta, were also highly represented in the List (Table A).

The majority of the 121 vertebrates listed here are fish (Actinopterygii in Table A), being Perciformes and Cypriniforms the dominant orders with 34 and 27 taxa, respectively. Following those, reptiles and amphibians were the larger groups, at least 15 and 12 species respectively showed a likely risk of introduction in Iberian inland waters. Even though some aquatic or semiaquatic taxa of birds and mammals are among the worst invasive species, only 3 and 2 taxa, respectively, were included in the List.

Most of the invertebrates included in the List are crustaceans (49 taxa, 50% of the listed invertebrates) and molluscs (27 taxa, 27.6%) (Table A). Malacostraca is the dominant order among the first, and Bivalvia and Gastropoda represented the 96.3% 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 context of biological invasions. For instance, an underestimate of parasitic and ectocommensal taxa of invertebrates should be assumed in the List presented here.

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 38 species listed (23 Liliopsida and 15 Magnoliopsida) whereas only 3 taxa were listed for the group of Pteridophyta (Table A)."

Among macroalgae, clearly Rhodophyta was the dominant group (7 taxa). This reflects part of the difficulties in the assessment of the invasion processes for these taxonomic groups, and similarly to invertebrates, the number of macroalgae could also be considered as underestimated in the outcoming List.

In general, the existence of taxonomic-related biases among alien species information due to knowledge gaps can be confirmed with the data presented here. It is quite likely that some taxonomic groups, particularly diverse and able to thrive in inland waters, were underrepresented (e.g. annelids, nematodes, plathelmyntes, chlorophytes or ochrophytes). Although the updated List can be considered exhaustive and complete regarding the available information, the number of exotic species included in the List is still likely to be larger than the showed herein.

Table A. Number of aquatic alien taxa included in the List by taxonomic groups (Phylum and Class). total taxa defined as potential are presented.

	Phylum	Class	Potential
VERTEBRATES	**Chordata**		**121**
		Actinopterygii	90
		Amphibia	11
		Reptilia	15
		Aves	3
		Mammalia	2
INVERTEBRATES	**Chordata**		**6**
		Ascidiacea	6
	Annelida		**5**
		Clitellata	1
		Polychaeta	4
	Arthropoda		**52**
		Branchipoda	3
		Hexanauplia	3
		Insecta	3
		Malacostraca	42
		Maxillopoda	1
	Bryozoa		**1**
		Gymnolaemata	1
	Cnidaria		**4**
		Cubozoa	1
		Hydrozoa	1
		Scyphozoa	2
	Ctenophora		**1**
		Nuda	1
	Entoprocta		**1**
		Entoprocta	1
	Mollusca		**27**
		Bivalvia	14
		Gastropoda	12
		Polyplacophora	1
	Porifera		**1**
		Demospongiae	1
PLANTS	**Magnoliophyta**		**38**
		Liliopsida	23
		Magnoliopsida	15
	Pteridophyta		**3**
		Polypodiopsida	3
MACROALGAE/ FUNGI	**Chlorophyta**		**2**
		Ulvophyceae	2
	Ochrophyta		**2**
		Phaeophyceae	2
	Rhodophyta		**7**
		Florideophyceae	7
	Chytridiomycota		**1**
		Chytridiomycetes	1
	Total	**(30 Classes)**	**272**

BOX 3 – Examples of alien species listed as potential to the Iberian inland waters

Amur sleeper
Perccottus glenii Dybowski, 1877

The Amur sleeper is considered one of the most widespread and harmful alien fish in European inland waters. Native to East of Asia, since its first introduction in Europe (European part of Russia), non native populations have been identified in more than fifteen countries in the central and easthern areas. Amur sleeper is a voracious predator fish which represents a serious threat to aquatic fauna as it forages on a wide range of preys including invertebrates, fish and amphibians. Thus, it can significantly affect the trophic structure of some water bodies and even lead to local extinction of native species. It can rapidly spread through canals and it was also accidentally introduced as contamination of stocked fish. Amur slepper is also kept in aquaria and used as live bait, activities that could be additional reasons for uncontrolled introductions. Considering its widespread and rapid invasion in Europe and its impact on native biota it has been assigned to the European List of Invasive Alien Species. Previosly, Amur slepper has been listed as one of the top 27 animal IAS introduced in Europe for aquaculture and related activities, which includes species that cause serious threat to biodiversity.

Marbled crayfish
Procambarus virginalis (Lyko, 2017)

Marmorkrebs or marbled crayfish are one of the most popular crayfish in the world pet trade. In fact, this crayfish was first discovered in the pet trade in Germany in the mid-1990s. The species has recently been described and was considered a morpho, *Procambarus fallax* f *virginalis*, which originally distributed throughout the Florida peninsula (North America), but the marbled lineage origin is unknown. This lineage is characterised by its conspicuous colour pattern (like marble) and its parthenogenetic reproduction. This reproductive capacity makes marmorkrebs a harmful potential invasive species because only one specimen is needed to establish a new population. Although marbled crayfish pet trade was widely extended for several years globally without severe consequences, first wild samples were detected in Europe and Madagascar in 2003. They are currently being found in the wild in several countries of Europe, Madagascar, and Asian countries as Taiwan and Japan. In some countries as Madagascar, marmorkrebs have grown rapidly, becoming a severe threat for freshwater ecosystems and native biodiversity. Principal economic impacts are related to rice culture and inland fisheries. Besides, marbled crayfish competes with native crayfishes and transmits crayfish plague pathogen, *Aphanomyces astaci*, water fungus that infects native crayfish, causing high levels of mortality on infected populations.

Quagga mussels
Dresissena rostriformis bugensis Andrusov, 1897

The common name of this freshwater bivalve mollusc is quagga mussel, in contraposition to the related zebra mussel *Dreissena polymorpha* because, like the extinct quagga, its stripes fade out towards the ventral side. In the same way that zebra mussel, this bivalve is an invasive species in Europe and North America. Quagga mussel is native to the estuarine region of the rivers Dnieper and Southern Bug (Ukraine). The expansion in Europe after 1940 is associated with the construction of interbasin canals and reservoirs and the development of these structures in the large European rivers. Currently, this species is found throughout several western Europe countries. Subsequently, this mollusc was introduced into North America in the mid-1980s, presumably through ballast water discharge. It is a filter feeder capable of reaching too high densities. Principal impacts are over food webs and biodiversity of the freshwater ecosystems. Besides, economic effects are very noticeable, as it forms dense sessile colonies which block pipelines and preclude water provision for human consumption, hydroelectric stations and agricultural purposes.

Carolina fanwort
Cabomba caroliniana A. Gray

Carolina fanwort is a highly adaptable submersed aquatic macrophyte whose attractive flowers and finely dissected leaves have made it a popular aquarium plant. It is native to South America and reaches some USA territories. Besides, it has also invaded some regions in the world such as Canada, Asia and Australia. In Europe, carolina fanwort is established in, at least, Austria, France, Hungary, the Netherlands, Belgium, Germany and Great Britain. This is the only species in the Cabombaceae family that behaves as a weed or invasive plant causing biodiversity loss among native aquatic plants. Its fast growing allows it to develop thick mats that crowd out native plants. The mats block sunlight to submerged plants and plankton, reduce dissolved oxygen, alter the processes of decomposition and disrupt fish and macroinvertebrate communities. Likewise, dense stands of the species cause clogs in drainage channels and streams and preclude some recreational uses of waterways, lakes, and ponds (they can hamper bathing, fishing and boating activities). It also has a high natural dispersal potential due to its ability to readily fragment and spread both actively and passively. Carolina fanwort spreads largely through activities related to the aquarium trade. In fact, the species is widely available from aquarium plant distributors and has long been recommended for use in aquarium gardening.

Snakehead
Channa argus (Cantor, 1842)

© Hagerty Ryan, USFWS

The snakehead is native from southern and eastern China and was introduced to Japan in the early 1900s. The species can survive out of water for up to three or four days and commonly escapes from ponds where it has been introduced to, dispersing into new areas and establishing populations relatively quickly in new water bodies. The snakehead inhabits shallow, marshy ponds and wetlands and is an ambush predator that wait for its prey on the bottom affecting native fauna. It is widely distributed in USA and, at least, three countries in Europe have shown records. The species is not involved in the aquarium fish trade but is sold aquaculture and in live food fish markets as a food fish. The most likely pathway in Europe is the introduction by escape from aquiculture or perhaps in relation to angling. The genera *Channa* is included in the Spanish IAS catalog and in the Portuguese National List of IAS.

Cane Toad or Marine Toad
Rhinella marina (Linnaeus, 1758)

Cane toads were introduced to many countries as biological control agents, mainly for insect pests of sugarcane and other crops. The species is also kept in pets trade, activity that could be additional reasons for uncontrolled introductions. The species is native to northern South America, Central America, and Mexico. The cane toad has been proved to impact negatively on freshwater biodiversity. It feeds on almost any terrestrial animal and competes with native amphibians for food and breeding habitats. Their toxic secretions are known to cause illness and death in domestic animals that come into contact with them, and wildlife, such as snakes and lizards. When threatened, they are able to squirt the toxic secretion over a metre, causing extreme pain if rubbed into the eyes. Human poisoning have been recorded following ingestion of the eggs or adults. The species is included in the Spanish IAS catalog and in the Portuguese National List of IAS.

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 base information for the enforcement of the EWRR framework at national level. We believe that the outcoming List of potential taxa will help Spain and Portugal to 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 of potential taxa is a dynamic tool that will evolve with time according to new information or situations. It is aimed at stimulating and supporting research, monitoring, and management actions, mainly in prevention measures, at local, regional and trans-national levels. The resulting List is part of a wider LIFE INVASAQUA initiative aimed also at assessing the status of potential and recorded Iberian aquatic alien species. This initiative will provide key resources for decision-makers, environmental managers, NGOs, and other stakeholders by compiling information on biology, ecology, and recommended management measures for several IAS. The outputs can be applied to inform policy, to identify priority potential IAS to include in regulations, and to identify priority pathways of invasion to include in management plans. All the information generated by the LIFE INVASAQUA project will be freely available on its Websites (http://www.lifeinvasaqua.com/; https://eei.sibic.org/), and/or through different technical reports.

Ultimately, in order to highlight the worst potential IAS in the Iberian inland waters, a new approach is required to prioritise the threat posed by the established taxa and 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 information of potential alien taxa.
- For those groups with taxonomic problems or difficulties, improved species identification is required in all monitoring programmes as well as scientific surveys. For that purpose, trainings of species identification for stakeholders or key groups, such as surveillance agents, should be provided.
- Update the list on a regular basis and when new information of potential alien taxa becomes available.
- Conduct basic and applied biological research for the included potential alien species, especially those that are involved in the main pathways or with a high need of control and management in the case of its introduction.

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Planta de té de Senegal (*Gymnocoronis spilanthoides*) © Leonel Roget. CC-BY-SA-4.0

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Appendix A

List of potential aquatic alien species to the Iberian inland waters

List of potential taxa that have not yet recorded in the inland waters of the Iberian Peninsula but with high risk of invasion in those aquatic systems (status = **potential**). More information about taxa (synonyms, native geographic range, inclusion in IAS Regulation, in IAS databases, and in key literature references) is included in the supplementary database (http://www.ibermis.org/) (http://www.lifeinvasaqua.com/).

VERTEBRATES				
Scientific name	**Phylum**	**Class**	**Order**	**Family**
Aix sponsa Linnaeus, 1758	Chordata	Aves	Anseriformes	Anatidae
Alburnoides bipunctatus (Bloch, 1782)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Ameiurus catus (Linnaeus, 1758)	Chordata	Actinopterygii	Siluriformes	Ictaluridae
Ameiurus nebulosus (Lesueur, 1819)	Chordata	Actinopterygii	Siluriformes	Ictaluridae
Anotheca spinosa (Steindachner, 1864)	Chordata	Amphibia	Anura	Hylidae
Anser cygnoides (Linnaeus, 1758)	Chordata	Aves	Anseriformes	Anatidae
Apalone spinifera (LeSueur, 1827)	Chordata	Reptilia	Testudines	Trionychidae
Astronotus ocellatus (Agassiz, 1831)	Chordata	Actinopterygii	Perciformes	Cichlidae
Babka gymnotrachelus (Kessler, 1857)	Chordata	Actinopterygii	Perciformes	Gobiidae
Barbonymus schwanenfeldii (Bleeker, 1853)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Barbus barbus (Linnaeus, 1758)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Benthophilus nudus Berg, 1898	Chordata	Actinopterygii	Perciformes	Gobidae
Bufotes balearicus (Boettger, 1880)	Chordata	Amphibia	Anura	Bufonidae
Caiman crocodilus (Linnaeus, 1758)	Chordata	Reptilia	Crocodylia	Alligatoridae
Carassius carassius (Linnaeus, 1758)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Castor canadensis Kuhl, 1820	Chordata	Mammalia	Rodentia	Castoridae
Catostomus commersonii (Lacepède, 1803)	Chordata	Actinopterygii	Cypriniformes	Catostomidae
Channa argus (Cantor, 1842)	Chordata	Actinopterygii	Perciformes	Channidae
Channa micropeltes (Cuvier, 1831)	Chordata	Actinopterygii	Perciformes	Channidae
Channa panaw Musikasinthorn, 1998	Chordata	Actinopterygii	Perciformes	Channidae
Chelus fimbriata Schneider (1783)	Chordata	Reptilia	Testudines	Chelidae
Chondrostoma nasus (Linnaeus, 1758)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Chrosomus eos Cope, 1861	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Clarias batrachus (Linnaeus, 1758)	Chordata	Actinopterygii	Siluriformes	Clariidae
Clarias gariepinus (Burchell, 1822)	Chordata	Actinopterygii	Siluriformes	Clariidae
Claudius angustatus (Cope, 1865)	Chordata	Reptilia	Testudines	Kinosternidae
Coptodon zillii (Gervais, 1848)	Chordata	Actinopterygii	Perciformes	Cichlidae
Coregonus nasus (Pallas, 1776)	Chordata	Actinopterygii	Salmoniformes	Salmonidae
Crocodylus niloticus Laurenti, 1768	Chordata	Reptilia	Crocodylia	Crocodylidae
Ctenopharyngodon idella (Valenciennes, 1844)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Culaea inconstans (Kirtland, 1840)	Chordata	Actinopterygii	Gasterosteiformes	Gasterosteidae
Cygnus olor (Gmelin, 1789)	Chordata	Aves	Anseriformes	Anatidae
Cynoglossus sinusarabici (Chabanaud, 1931)	Chordata	Actinopterygii	Pleuronectiformes	Cynoglossidae
Cyprinella lutrensis (Baird & Girard, 1853)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Decapterus russelli (Rüppell, 1830)	Chordata	Actinopterygii	Perciformes	Carangidae
Dracaena guianensis Daudin, 1802	Chordata	Reptilia	Squamata	Teiidae
Duttaphrynus melanostictus (Schneider, 1799)	Chordata	Amphibia	Anura	Bufonidae
Eleutheridactylus planirostris (Cope, 1862)	Chordata	Amphibia	Anura	Eleutherodactylidae
Eleutherodactylus coqui Thomas, 1966	Chordata	Amphibia	Anura	Eleutherodactylidae

Eleutherodactylus martinicensis (Tschudi, 1838)	Chordata	Amphibia	Anura	Eleutherodactylidae
Gambusia affinis (Baird & Girard, 1853)	Chordata	Actinopterygii	Cyprinodontiformes	Poeciliidae
Gobio alverniae Kottelat & Persat, 2005	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Gobio gobio (Linnaeus, 1758)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Gymnocephalus cernuus (Linnaeus, 1758)	Chordata	Actinopterygii	Perciformes	Percidae
Hemichromis fasciatus Peters, 1857	Chordata	Actinopterygii	Perciformes	Cichlidae
Hemichromis letourneauxi Sauvage, 1880	Chordata	Actinopterygii	Perciformes	Cichlidae
Hypophthalmichthys molitrix (Valenciennes, 1844)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Hypophthalmichthys nobilis (Richardson, 1845)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Hypostomus plecostomus (Linnaeus, 1758)	Chordata	Actinopterygii	Siluriformes	Loricariidae
Ictiobus bubalus (Rafinesque, 1818)	Chordata	Actinopterygii	Cypriniformes	Catostomidae
Ictiobus cyprinellus (Valenciennes, 1844)	Chordata	Actinopterygii	Cypriniformes	Catostomidae
Ictiobus niger (Rafinesque, 1819)	Chordata	Actinopterygii	Cypriniformes	Catostomidae
Knipowitschia longecaudata (Kessler, 1877)	Chordata	Actinopterygii	Perciformes	Gobiidae
Lagocephalus sceleratus (Gmelin, 1789)	Chordata	Actinopterygii	Tetraodontiformes	Tetraodontidae
Lates calcarifer (Bloch, 1790)	Chordata	Actinopterygii	Perciformes	Latidae
Lates niloticus (Linnaeus, 1758)	Chordata	Actinopterygii	Perciformes	Latidae
Lepisosteus spp. Lacepède, 1802	Chordata	Actinopterygii	Lepisosteiformes	Lepisosteidae
Lepomis cyanellus Rafinesque, 1819	Chordata	Actinopterygii	Perciformes	Centrarchidae
Leucaspius delineatus (Heckel, 1843)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Leuciscus leuciscus (Linnaeus, 1758)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Lota lota (Linnaeus, 1758)	Chordata	Actinopterygii	Gadiformes	Lotidae
Macrochelys temminckii Troost, 1835	Chordata	Reptilia	Testudines	Chelydridae
Megalobrama terminalis (Richardson, 1846)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Melanochromis auratus (Boulenger 1897)	Chordata	Actinopterygii	Perciformes	Cichlidae
Micropercops cinctus (DabrydeThiersant, 1872)	Chordata	Actinopterygii	Perciformes	Odontobutidae
Micropogonias undulatus (Linnaeus, 1766)	Chordata	Actinopterygii	Perciformes	Sciaenidae
Micropterus dolomieu Lacepède, 1802	Chordata	Actinopterygii	Perciformes	Centrarchidae
Misgurnus fossilis (Linnaeus, 1758)	Chordata	Actinopterygii	Cypriniformes	Cobitidae
Monopterus albus (Zuiew, 1793)	Chordata	Actinopterygii	Synbranchiformes	Synbranchidae
Morone americana (Gmelin, 1789)	Chordata	Actinopterygii	Perciformes	Moronidae
Morone chrysops (Rafinesque, 1820)	Chordata	Actinopterygii	Perciformes	Moronidae
Morone saxatilis (Walbaum, 1792)	Chordata	Actinopterygii	Perciformes	Moronidae
Mylopharyngodon piceus (Richardson, 1846)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Neogobius fluviatilis (Pallas, 1814)	Chordata	Actinopterygii	Perciformes	Gobiidae
Neogobius melanostomus (Pallas, 1814)	Chordata	Actinopterygii	Perciformes	Gobiidae
Nyctereutes procyonoides (Gray, 1834)	Chordata	Mammalia	Carnivora	Canidae
Odontesthes bonariensis (Valenciennes, 1835)	Chordata	Actinopterygii	Atheriniformes	Atherinopsidae
Oncorhynchus clarkii (Richardson, 1836)	Chordata	Actinopterygii	Salmoniformes	Salmonidae
Oncorhynchus gorbuscha (Walbaum, 1792)	Chordata	Actinopterygii	Salmoniformes	Salmonidae
Oncorhynchus nerka (Walbaum, 1792)	Chordata	Actinopterygii	Salmoniformes	Salmonidae
Oreochromis aureus (Steindachner, 1864)	Chordata	Actinopterygii	Perciformes	Cichlidae
Oreochromis mossambicus (Peters, 1852)	Chordata	Actinopterygii	Perciformes	Cichlidae
Oreochromis niloticus (Linnaeus, 1758)	Chordata	Actinopterygii	Perciformes	Cichlidae
Oryzias sinensis Chen, Uwa & Chu, 1989	Chordata	Actinopterygii	Beloniformes	Adrianichthyidae
Osmerus mordax (Mitchill, 1814)	Chordata	Actinopterygii	Osmeriformes	Osmeridae
Pachychilon pictum (Heckel & Kner, 1858)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Parabramis pekinensis (Basilewsky, 1855)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Paralichthys olivaceus (Temminck & Schlegel,1846)	Chordata	Actinopterygii	Pleuronectiformes	Paralichthyidae
Pelmatolapia mariae (Boulenger, 1899)	Chordata	Actinopterygii	Perciformes	Cichlidae

Pelomedusa subrufa (Bonnaterre, 1789)	Chordata	Reptilia	Testudines	Pelomedusidae
Pelophylax bedriagae (Camerano, 1882)	Chordata	Amphibia	Anura	Ranidae
Pelophylax cf. *esculentus* (Linnaeus, 1758)	Chordata	Amphibia	Anura	Ranidae
Pelophylax lessonae (Camerano, 1882)	Chordata	Amphibia	Anura	Ranidae
Pelophylax saharicus (Boulenger, 1913)	Chordata	Amphibia	Anura	Ranidae
Perccottus glenii Dybowski, 1877	Chordata	Actinopterygii	Perciformes	Odontobutidae
Phoxinus phoxinus (Linnaeus, 1758)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Piaractus brachypomus (Cuvier, 1818)	Chordata	Actinopterygii	Characiformes	Serrasalmidae
Pimephales promelas Rafinesque, 1820	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Planiliza haematocheila (Temminck & Schlegel, 1845)	Chordata	Actinopterygii	Mugiliformes	Mugilidae
Plotosus lineatus (Thunberg, 1787)	Chordata	Actinopterygii	Siluriformes	Plotosidae
Ponticola gorlap (Iljin, 1949)	Chordata	Actinopterygii	Perciformes	Gobiidae
Ponticola kessleri (Günther, 1861)	Chordata	Actinopterygii	Perciformes	Gobiidae
Proterorhinus marmoratus (Pallas, 1814)	Chordata	Actinopterygii	Perciformes	Gobiidae
Proterorhinus semilunaris (Heckel, 1837)	Chordata	Actinopterygii	Perciformes	Gobiidae
Pseudemys floridana (LeConte, 1830)	Chordata	Reptilia	Testudines	Emydidae
Pseudemys peninsularis (Carr, 1938)	Chordata	Reptilia	Testudines	Emydidae
Pseudemys rubriventris (Le Conte, 1830)	Chordata	Reptilia	Testudines	Emydidae
Pygocentrus nattereri Kner, 1858	Chordata	Actinopterygii	Characiformes	Serrasalmidae
Rhinella marina (Linnaeus, 1758)	Chordata	Amphibia	Anura	Bufonidae
Rhodeus amarus (Bloch, 1782)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Salvelinus alpinus (Linnaeus, 1758)	Chordata	Actinopterygii	Salmoniformes	Salmonidae
Salvelinus Namaycush (Walbaum, 1792)	Chordata	Actinopterygii	Salmoniformes	Salmonidae
Sander vitreus (Mitchill, 1818)	Chordata	Actinopterygii	Perciformes	Percidae
Saurida undosquamis (Richardson, 1848)	Chordata	Actinopterygii	Aulopiformes	Synodontidae
Squalius cephalus (Linnaeus, 1758)	Chordata	Actinopterygii	Cypriniformes	Cyprinidae
Sternotherus odorathus (Latreille, 1802)	Chordata	Reptilia	Testudines	Kinosternidae
Trachemys decussata (Gray, 1831)	Chordata	Reptilia	Testudines	Emydidae
Trachemys emolli (Legrer, 1990)	Chordata	Reptilia	Testudines	Emydidae
Trachemys ornata (Gray, 1831)	Chordata	Reptilia	Testudines	Emydidae
Umbra pygmaea (DeKay, 1842)	Chordata	Actinopterygii	Esociformes	Umbridae
Xiphophorus hellerii Heckel, 1848	Chordata	Actinopterygii	Cyprinodontiformes	Poeciliidae

INVERTEBRATES				
Scientific name	**Phylum**	**Class**	**Order**	**Family**
Aedes aegypti (Linnaeus, 1762)	Arthropoda	Insecta	Diptera	Culicidae
Aedes koreicus (Edwards, 1917)	Arthropoda	Insecta	Diptera	Culicidae
Anadara inaequivalvis (Bruguière, 1789)	Mollusca	Bivalvia	Arcida	Arcidae
Anopheles quadrimaculatus Say, 1824	Arthropoda	Insecta	Diptera	Culicidae
Aplidium accarense (Millar, 1953)	Chordata	Ascidiacea	Aplousobranchia	Polyclinidae
Aulacomya atra (Molina, 1782)	Mollusca	Bivalvia	Mytilida	Mytilidae
Batillaria attramentaria (G.B. Sowerby II, 1855)	Mollusca	Gastropoda	Unassigned	Batillariidae
Beroe spp. Browne, 1756	Ctenophora	Nuda	Beroida	Beroidae
Botrylloides giganteum (Pérès, 1949)	Chordata	Ascidiacea	Stolidobranchia	Styelidae
Carybdea marsupialis (Linnaeus, 1758)	Cnidaria	Cubozoa	Carybdeida	Carybdeidae
Caspiobdella fadejewi Epshtein, 1961	Annelida	Clitellata	Rhynchobdellida	Piscicolidae
Celtodoryx ciocalyptoides (Burton, 1935)	Porifera	Demospongiae	Poecilosclerida	Coelospharidae
Cercopagis pengoi (Ostroumov, 1891)	Arthropoda	Branchipoda	Diplostraca	Cercopagidae
Chaetogammarus spp. Martynov, 1924	Arthropoda	Malacostraca	Amphipoda	Gammaridae
Chaetopleura angulata (Spengler, 1797)	Mollusca	Polyplacophora	Chitonida	Chaetopleuridae
Chelicorophium spp. Bousfield & Hoover, 1997	Arthropoda	Malacostraca	Amphipoda	Corophiidae
Cherax cainii Austin and Ryan, 2002	Arthropoda	Malacostraca	Decapoda	Parastacidae
Crepidula onyx G. B. Sowerby I, 1824	Mollusca	Gastropoda	Littorinimorpha	Calyptraeidae
Daphnia lumholtzi G.O. Sars, 1885	Arthropoda	Branchipoda	Diplostraca	Daphniidae
Didemnum perlucidum Monniot F., 1983	Chordata	Ascidiacea	Aplousobranchia	Didemnidae
Dikerogammarus aralychensis (Birstein, 1932)	Arthropoda	Malacostraca	Amphipoda	Gammaridae
Dikerogammarus haemobaphes (Eichwald, 1841)	Arthropoda	Malacostraca	Amphipoda	Gammaridae
Dikerogammarus villosus (Sowinsky, 1894)	Arthropoda	Malacostraca	Amphipoda	Gammaridae
Dreissena rostriformis bugensis Andrusov, 1897	Mollusca	Bivalvia	Myida	Dreissenidae
Dyspanopeus texanus (Stimspon, 1859)	Arthropoda	Malacostraca	Decapoda	Panopeidae
Echinogammarus spp. Stebbing, 1899	Arthropoda	Malacostraca	Amphipoda	Eulimnogammaridae
Ecteinascidia thurstoni Herdman, 1890	Chordata	Ascidiacea	Phlebobranchia	Perophoridae
Eurytemora spp. Giesbrecht, 1881	Arthropoda	Hexanauplia	Calanoida	Temoridae
Faxonius rusticus (Girard, 1852)	Arthropoda	Malacostraca	Decapoda	Cambaridae
Faxonius virilis (Hagen, 1870)	Arthropoda	Malacostraca	Decapoda	Cambaridae
Gammarus fasciatus Say, 1818	Arthropoda	Malacostraca	Amphipoda	Gammaridae
Gammarus tigrinus Sexton, 1939	Arthropoda	Malacostraca	Amphipoda	Gammaridae
Gemma gemma (Totten, 1834)	Mollusca	Bivalvia	Venerida	Veneridae
Gillia altilis (I. Lea, 1841)	Mollusca	Gastropoda	Neotaenioglossa	Lithoglyphidae
Grandidierella japonica Stephensen, 1938	Arthropoda	Malacostraca	Amphipoda	Aoridae
Hemigrapsus spp *(nec H. takanoi)* Dana, 1851	Arthropoda	Malacostraca	Decapoda	Varunidae
Hemimysis anomala G.O. Sars, 1907	Arthropoda	Malacostraca	Mysida	Mysidae
Homarus americanus H. Milne Edwards, 1837	Arthropoda	Malacostraca	Decapoda	Nephropidae
Hydroides dirampha Mörch, 1863	Annelida	Polychaeta	Sabellida	Serpulidae
Ianiropsis serricaudis (Gurjanova, 1936)	Arthropoda	Malacostraca	Isopoda	Janiroidea
Ilyanassa obsoleta (Say, 1822)	Mollusca	Gastropoda	Neogastropoda	Nassariidae
Jaera (Jaera) istri Veuille, 1979	Arthropoda	Malacostraca	Isopoda	Janiridae
Jasus lalandii (H. Milne Edwards, 1837)	Arthropoda	Malacostraca	Decapoda	Palinuridae
Katamysis warpachowsky G.O. Sars, 1893	Arthropoda	Malacostraca	Mysida	Mysidae
Laonome calida Capa, 2007	Annelida	Polychaeta	Sabellida	Serpulidae
Lasmigona subviridis (Conrad, 1835)	Mollusca	Bivalvia	Unionida	Unionidae
Libinia dubia (H. Milne Edwards, 1834)	Arthropoda	Malacostraca	Decapoda	Epialtidae
Limnomysis benedeni Czerniavsky, 1882	Arthropoda	Malacostraca	Mysida	Mysidae
Lithoglyphus naticoides (C. Pfeiffer, 1828)	Mollusca	Gastropoda	Littorinimorpha	Lithoglyphidae
Lymnaea peregra (Müller, 1774)	Mollusca	Gastropoda	Unassigned	Lymnaeidae
Macrorhynchia philippina Kirchenpauer, 1872	Cnidaria	Hydrozoa	Leptothecata	Aglaopheniidae
Marenzelleria spp Mesnil, 1896	Annelida	Polychaeta	Spionida	Spionidae
Matuta victor (Fabricius, 1781)	Arthropoda	Malacostraca	Decapoda	Matutidae

Megabalanus coccopoma (Darwin, 1854)	Arthropoda	Maxillopoda	Sessilia	Balanidae
Microcosmus exasperatus Heller, 1878	Chordata	Ascidiacea	Stolidobranchia	Pyuridae
Myicola ostreae Hoshina & Sugiura, 1953	Arthropoda	Hexanauplia	Cyclopoida	Myicolidae
Myra subgranulata Kossmann, 1877	Arthropoda	Malacostraca	Decapoda	Leucosiidae
Mytilopsis adamsi Morrison, 1946	Mollusca	Bivalvia	Myida	Dreissenidae
Mytilopsis sallei (Récluz, 1849)	Mollusca	Bivalvia	Myida	Dreissenidae
Neocaridina heteropoda Liang, 2002	Arthropoda	Malacostraca	Decapoda	Aytidae
Nuttallia obscurata (Reeve, 1857)	Mollusca	Bivalvia	Cardiida	Psammobiidae
Obesogammarus obesus (G.O. Sars, 1894)	Arthropoda	Malacostraca	Amphipoda	Pontogammaridae
Ogyrides mjoebergi (Balss, 1921)	Arthropoda	Malacostraca	Decapoda	Ogyrididae
Panopeus occidentalis de Saussure, 1857	Arthropoda	Malacostraca	Decapoda	Panopeidae
Paracaprella pusilla Mayer, 1890	Arthropoda	Malacostraca	Amphipoda	Caprellidae
Paranthura japonica Richardson, 1909	Arthropoda	Malacostraca	Isopoda	Paranthuridae
Percnon gibbesi (H. Milne Edwards, 1853)	Arthropoda	Malacostraca	Decapoda	Percnidae
Peregriana peregra (O.F. Müller, 1774)	Mollusca	Gastropoda	Unassigned	Lymnaeidae
Perna viridis (Linnaeus, 1758)	Mollusca	Bivalvia	Mytilida	Mytilidae
Phyllorhiza punctata von Lendenfeld, 1884	Cnidaria	Scyphozoa	Rhizostomeae	Mastigiidae
Planorbella trivolvis (Say, 1817)	Mollusca	Gastropoda	Basommatophora	Planorbidae
Platorchestia platensis (Krøyer, 1845)	Arthropoda	Malacostraca	Amphipoda	Talitridae
Pomacea gigas Perry, 1811	Mollusca	Gastropoda	Architaenioglossa	Ampullariidae
Portunus segnis (orskål, 1775)	Arthropoda	Malacostraca	Decapoda	Portunidae
Potamocorbula amurensis (Schrenck, 1861)	Mollusca	Bivalvia	Myida	Corbulidae
Potamon fluviatile (Herbst, 1785)	Arthropoda	Malacostraca	Decapoda	Potamidae
Potamon ibericum (Bieberstein, 1808)	Arthropoda	Malacostraca	Decapoda	Potamidae
Procambarus alleni (Faxon, 1884)	Arthropoda	Malacostraca	Decapoda	Astacidae
Procambarus virginalis (Lyko 2017)	Arthropoda	Malacostraca	Decapoda	Astacidae
Pseudomyicola spinosus (Raffaele & Monticelli, 1885)	Arthropoda	Malacostraca	Cyclopoida	Myicolidae
Pteria colymbus (Röding, 1798)	Mollusca	Bivalvia	Ostreida	Pteriidae
Rangia cuneata (G. B. Sowerby I, 1832)	Mollusca	Bivalvia	Venerida	Mactridae
Rhopilema nomadica Galil, 1990	Cnidaria	Scyphozoa	Rhizostomeae	Rhizostomatidae
Skistodiaptomus pallidus (Herrick, 1879)	Arthropoda	Hexanauplia	Calanoida	Diaptomidae
Sphaeroma quoianum H. Milne Edwards, 1840	Arthropoda	Malacostraca	Isopoda	Sphaeromatidae
Sphaeroma walkeri Stebbing, 1905	Arthropoda	Malacostraca	Isopoda	Sphaeromatidae
Spirorbis (Spirorbis) marioni Caullery & Mesnil, 1897	Annelida	Polychaeta	Sabellida	Serpulidae
Spondylus spinosus Schreibers, 1793	Mollusca	Bivalvia	Pectinida	Spondylidae
Stenothoe georgiana Bynum & Fox 1977	Arthropoda	Malacostraca	Amphipoda	Stenothoidae
Symplegma brakenhielmi (Michaelsen, 1904)	Chordata	Ascidiacea	Stolidobranchia	Styelidae
Theodoxus danubialis (C. Pfeiffer, 1828)	Mollusca	Gastropoda	Cycloneritida	Neritidae
Trachysalambria palaestinensis (Steinitz, 1932)	Arthropoda	Malacostraca	Decapoda	Penaeidae
Triops longicaudatus LeConte, 1846	Arthropoda	Branchipoda	Notostraca	Triopsidae
Urnatella gracilis Leidy, 1851	Entoprocta	Entoprocta	Urnatellida	Barentsiidae
Urosalpinx cinerea (Say, 1822)	Mollusca	Gastropoda	Neogastropoda	Muricidae
Viviparus georgianus (I. Lea, 1834)	Mollusca	Gastropoda	Architaenioglossa	Viviparidae
Watersipora subatra (Ortmann, 1890	Bryozoa	Gymnolaemata	Cheilostomatida	Watersiporidae
Xenostrobus spp *(nec X. securis)* Habe, 1981	Mollusca	Bivalvia	Mytilida	Mytilidae

PLANTS				
Scientific name	**Phylum**	**Class**	**Order**	**Family**
Aponogeton distachyos L.fil.	Magnoliophyta	Liliopsida	Alismatales	Aponogetonaceae
Azolla mycrophilla Kaulf.	Pteridophyta	Polypodiopsida	Salviniales	Salviniaceae
Cabomba caroliniana A.Gray	Magnoliophyta	Magnoliopsida	Nymphaeales	Cabombaceae
Callitriche deflexa A.Braun ex. Hegelm.	Magnoliophyta	Magnoliopsida	Lamiales	Plantaginaceae
Crassula helmsii (Kirk) Cockayne	Magnoliophyta	Magnoliopsida	Saxifragales	Crassulaceae
Eichhornia diversifolia (Vahl) Urb.	Magnoliophyta	Liliopsida	Commelinales	Pontederiaceae
Elodea callitrichoides (Rich.) Casp.	Magnoliophyta	Liliopsida	Alismatales	Hydrocharitaceae
Elodea nuttallii (Planch.) H.St.John	Magnoliophyta	Liliopsida	Alismatales	Hydrocharitaceae
Gymnocoronis spilanthoides (D.Don ex Hook. & Arn.) DC.	Magnoliophyta	Magnoliopsida	Asterales	Asteraceae
Halophila stipulacea (Forssk.) Asch.	Magnoliophyta	Liliopsida	Alismatales	Hydrocharitaceae
Heteranthera zosterifolia Mart.	Magnoliophyta	Liliopsida	Commelinales	Pontederiaceae
Hydrilla verticillata (L.fil.) Royle	Magnoliophyta	Liliopsida	Alismatales	Hydrocharitaceae
Hydrocotyle moschata G.Forst.	Magnoliophyta	Magnoliopsida	Apiales	Apiaceae
Hydrocotyle sibthorpioides Lam.	Magnoliophyta	Magnoliopsida	Apiales	Apiaceae
Hygrophila polysperma (Roxb.) T. Anderson	Magnoliophyta	Magnoliopsida	Lamiales	Acanthaceae
Landoltia punctata (G.Mey) Les & D.J.Crawford	Magnoliophyta	Liliopsida	Alismatales	Araceae
Lemna aequinoctialis Welw.	Magnoliophyta	Liliopsida	Alismatales	Araceae
Lemna perpusilla Torr	Magnoliophyta	Liliopsida	Alismatales	Araceae
Lemna turionifera Landolt	Magnoliophyta	Liliopsida	Alismatales	Araceae
Ludwigia alternifolia L.	Magnoliophyta	Magnoliopsida	Myrtales	Onagraceae
Murdannia keisak (Hassk.) Hand. Mazz	Magnoliophyta	Liliopsida	Commelinales	Commelinaceae
Myriophyllum verrucosum Lindl.	Magnoliophyta	Magnoliopsida	Saxifragales	Saxifragales
Najas guadaluupensis (Spreng.) Magnus	Magnoliophyta	Liliopsida	Alismatales	Hydrocharitaceae
Nelumbo nucifera Gaerth.	Magnoliophyta	Magnoliopsida	Proteales	Nelumbonaceae
Nuphar advena (Aiton) W.T.Aiton	Magnoliophyta	Magnoliopsida	Nymphaeales	Nymphaeaceae
Nymphaea lotus L.	Magnoliophyta	Magnoliopsida	Nymphaeales	Nymphaeaceae
Orontium aquaticum L.	Magnoliophyta	Liliopsida	Alismatales	Araceae
Ottelia alismoides (L.) Pers.	Magnoliophyta	Liliopsida	Alismatales	Hydrocharitaceae
Pontederia cordata L.	Magnoliophyta	Liliopsida	Commelinales	Pontederiaceae
Potamogeton epihydrus Raf.	Magnoliophyta	Liliopsida	Alismatales	Potamogetonaceae
Rotala ramosior (L.) Koehne	Magnoliophyta	Magnoliopsida	Myrtales	Lythraceae
Rotala rotundifolia (Buch. Ham ex. Roxb) Koehne	Magnoliophyta	Magnoliopsida	Myrtales	Lythraceae
Sagittaria graminea Michx.	Magnoliophyta	Liliopsida	Alismatales	Alismataceae
Sagittaria platyphylla (Engelm.) J.G. Sm.	Magnoliophyta	Liliopsida	Alismatales	Alismataceae
Sagittaria rigida Pursh	Magnoliophyta	Liliopsida	Alismatales	Alismataceae
Salvinia auriculata Aubl.	Pteridophyta	Polypodiopsida	Salviniales	Salviniaceae
Salvinia minima Baker	Pteridophyta	Polypodiopsida	Salviniales	Salviniaceae
Saururus cernuus L.	Magnoliophyta	Magnoliopsida	Piperales	Saururaceae
Spartina anglica C.E.Hubb.	Magnoliophyta	Liliopsida	Poales	Poaceae
Vallisneria nana R.Br	Magnoliophyta	Liliopsida	Alismatales	Hydrocharitaceae
Zostera japonica Asch. & Graebn.	Magnoliophyta	Liliopsida	Alismatales	Zosteraceae

MACROALGAE/FUNGI				
Scientific name	**Phylum**	**Class**	**Order**	**Family**
Acrothamnion preissii (Sonder) E.M.Wollaston	Rhodophyta	Florideophyceae	Ceramiales	Ceramiaceae
Antithamnionella boergesenii (Cormaci & G.Furnari) Athanas.	Rhodophyta	Florideophyceae	Ceramiales	Ceramiaceae
Apoglossum gregarium (E.Y.Dawson) M.J.Wynne	Rhodophyta	Florideophyceae	Ceramiales	Delesseriaceae
Batrachochytrium salamandrivorans A.Martel, Blooi, Bossuyt & Pasmans	Chytridiomycota	Chytridiomycetes	Rhizophydiales	Incertae sedis
Caulerpa cilindracea Sonder	Chlorophyta	Ulvophyceae	Bryopsidales	Caulerpaceae
Caulerpa taxifolia (M.Vahl) C.Agardh	Chlorophyta	Ulvophyceae	Bryopsidales	Caulerpaceae
Dictyota cyanoloma Tronholm, De Clerck, Gomez Garreta & Rull Lluch	Ochrophyta	Phaeophyceae	Dictyotaceae	Phaeophyceae
Grateloupia imbricata Holmes	Rhodophyta	Florideophyceae	Halymeniales	Halymeniaceae
Hypnea spinella (C.Agardh) Kützing	Rhodophyta	Florideophyceae	Gigartinales	Cystocloniaceae
Lophocladia lallemandii (Montagne) F.Schmitz	Rhodophyta	Florideophyceae	Ceramiales	Rhodomelaceae
Polysiphonia atlantica Kapraun & J.N.Norris	Rhodophyta	Florideophyceae	Ceramiales	Rhodomelaceae
Stypopodium schimperi (Buchinger ex Kützing) Verlaque & Boudouresque	Ochrophyta	Phaeophyceae	Dictyotales	Dictyotaceae

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Appendix B

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

	Phylum	Class	Order	Potential
VERTEBRATES	**Chordata**			**121**
		Actinopterygii		**90**
			Atheriniformes	1
			Aulopiformes	1
			Beloniformes	1
			Characiformes	2
			Cypriniformes	27
			Cyprinodontiformes	2
			Esociformes	1
			Gadiformes	1
			Gasterosteiformes	1
			Lepisosteiformes	1
			Mugiliformes	1
			Osmeriformes	1
			Perciformes	34
			Pleuronectiformes	2
			Salmoniformes	6
			Siluriformes	6
			Synbranchiformes	1
			Tetraodontiformes	1
		Amphibia		**11**
			Anura	11
		Reptilia		**15**
			Crocodylia	2
			Squamata	1
			Testudines	12
		Aves		**3**
			Anseriformes	3
		Mammalia		**2**
			Carnivora	1
			Rodentia	1
INVERTEBRATES	**Chordata**			**6**
		Ascidiacea		**6**
			Aplousobranchia	2
			Phlebobranchia	1
			Stolidobranchia	3
	Annelida			**5**
		Clitellata		**1**
			Branchiobdellida	1
		Polychaeta		**4**
			Sabellida	4
	Arthropoda			**52**
		Branchipoda		**3**
			Anostraca	1
			Diplostraca	2

	Phylum	Class	Order	Potential
INVERTEBRATES		**Hexanauplia**		**3**
			Calanoida	2
			Cyclopoida	1
		Insecta		**3**
			Diptera	3
		Malacostraca		**42**
			Amphipoda	13
			Cyclopoida	1
			Decapoda	20
			Isopoda	5
			Mysida	3
		Maxillopoda		**1**
			Sessilia	1
	Bryozoa			**1**
		Gymnolaemata		**1**
			Cheilostomatida	1
	Cnidaria			**4**
		Cubozoa		**1**
			Carybdeida	1
		Hydrozoa		**1**
			Leptothecata	1
		Scyphozoa		**2**
			Rhizostomeae	2
	Ctenophora			**1**
		Nuda		1
			Beroida	1
	Entoprocta			**1**
		Entoprocta		1
			Urnatellida	1
	Mollusca			**27**
		Bivalvia		**14**
			Arcida	1
			Cardiida	1
			Myida	4
			Mytilida	3
			Ostreida	1
			Pectinida	1
			Unionida	1
			Venerida	2
		Gastropoda		**12**
			(unassigned)	3
			Architaenioglossa	2
			Basommatophora	1
			Cycloneritida	1
			Littorinimorpha	2
			Neogastropoda	2
			Neotaenioglossa	1
		Polyplacophora		**1**
			Chitonida	1
	Porifera			**1**
		Demospongiae		**1**
			Poecilosclerida	1

	Phylum	Class	Order	Potential
PLANTS	**Magnoliophyta**			**38**
		Liliopsida		**23**
			Alismatales	18
			Commelinales	4
			Poales	1
		Magnoliopsida		**15**
			Apiales	2
			Asterales	1
			Lamiales	2
			Myrtales	3
			Nymphaeales	3
			Piperales	1
			Proteales	1
			Saxifragales	2
	Pteridophyta			**3**
		Polypodiopsida		**3**
			Salviniales	3
MACROALGAE	**Chlorophyta**			**2**
		Ulvophyceae		**2**
			Bryopsidales	2
	Ochrophyta			**2**
		Phaeophyceae		**2**
			Dictyotales	2
	Rhodophyta			**7**
		Florideophyceae		**7**
			Ceramiales	5
			Gigartinales	1
			Halymeniales	1
FUNGI	**Chytridiomycota**			**1**
		Chytridiomycetes		**1**
			Rhizophydiales	1

Amur sleeper (*Perccottus glenii*)

Virile crayfish or nothern crayfish (*Faxionus virilis*)

Abstract

An updated list is presented of the alien species in the transport or introduction invasion stage in inland waters of 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 list is an important tool to support the implementation of the EU Regulation of Invasive Alien Species (IAS), particularly in prevention measures and in the development of an Early Warning and Rapid Response (EWRR) system. Ultimately, the included information can help to 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, 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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