

# STRATEGIC RECOMMENDATIONS FOR THE TRANSNATIONAL MANAGEMENT OF INVASIVE ALIEN CRAYFISH AND CRABS IN IBERIAN INLAND WATERS





LIFE **INVASA**QUA



Red swamp crayfish (*Procambarus clarkii*) © Javier Murcia Requena.

# **STRATEGIC RECOMMENDATIONS FOR THE TRANSNATIONAL MANAGEMENT OF INVASIVE ALIEN CRAYFISH AND CRABS IN IBERIAN INLAND WATERS**

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**LIFE INVASAQUA LIFE17 GIE/ES/000515**



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

## **LIFE INVASAQUA - Aquatic Invasive Alien Species of Freshwater and Estuarine Systems: Awareness and Prevention in the Iberian Peninsula. LIFE17 GIE/ES/000515**

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### **Abstract:**

An important goal of LIFE INVASAQUA is to develop tools that will improve management and increase the efficiency of the Early Warning and Rapid Response framework for Invasive Alien Species (IAS) in the Iberian Peninsula. We developed a participative process with experts in order to obtain Strategic Recommendations for the transnational management of invasive alien crayfish and crabs in inland waters of Spain and Portugal. They promote the coordinated management between Spain and Portugal, in order to facilitate implementation of international commitments and best practices and to support development of policies and targets on IAS management at Iberian scale. They were designed to serve as a guiding tool seeking to identify a strategic direction for the Spanish and Portuguese governance that is already being developed. The resulting Strategic Recommendations are important tools supporting the implementation of the IAS EU Regulation. Ultimately, the information included can be used for achieving the target of the EU Biodiversity Strategy to 2030 for combatting IAS, and also for implementing of other EU policies with requirements on alien species, such as the Birds and Habitats Directives, and the Marine Strategy and Water Framework Directives.



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Coordination members and beneficiaries of the LIFE INVASAQUA contributed by facilitating logistics in some of the workshops.



Spiny-cheek crayfish (*Faxonius limosus*) © Ivona\_Horká

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# Acronyms and short-names

**EASIN:** European Alien Species Information Network.

**EU:** European Union.

**EWRR:** Early Warning and Rapid Response framework.

**ICC:** Invasive Alien Crayfish and Crabs.

**ICC-WG:** Iberian working-group for ICC.

**IAS:** Invasive Alien Species.

**IAS EU 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.

**IAS – Office:** Transnational IAS coordination office.

**LIFE:** Financial Instrument for the Environment.

**MS:** Member State of the European Union.

**NGOs:** Non-governmental organisations.

**Portuguese National List of IAS:** The National List of Invasive Species (Annex II, Decreto-Lei 92/2019).  
**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 Catalogue:** The Spanish Catalogue of Invasive Alien Species (Annex, R.D. 630/2013).



Red swamp crayfish (*Procambarus clarkii*) © Javier Murcia Requena.



# 1

# Introduction & Scope

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

European Commission website (December 2022)

### **Invasive alien species: a priority for the EU biodiversity policy**

The Invasive Alien Species (IAS) are defined as species whose introduction and spread outside their natural ecological range poses a real threat to biodiversity and the economy (European Commission)<sup>1</sup>. The introduction of IAS can alter ecosystems and are one of the main anthropogenic global drivers of species extinctions, incurring high economic costs<sup>2</sup>. Although alien species have been entering Europe for centuries, their numbers have risen exponentially over the last 50 years, principally as a result of increased trade and travel, and the established IAS are unlikely to decrease in the near future<sup>3</sup>.

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

The *European Strategy on Invasive Alien Species*<sup>4</sup> developed under the Bern Convention, already highlighted the need for implementing coordinated measures among European states, to prevent or minimise the adverse effects of IAS. Recognising this need, the European Parliament and Council adopted the Regulation (EU) No 1143/2014 (hereafter referred to as the IAS EU Regulation) (BOX 1), aiming to establish common measures among MS to prevent the entry and spread of IAS within the EU territory.

1. European Commission. 2017. Invasive alien species: a European Union response, Directorate-General for Environment. Publications Office.

2. Diagne C., Leroy B., Vaissière A.C., Gozlan R.E., Roiz D., Jarić I., Salles J.M., Bradshaw C.J.A. and F. Courchamp. 2021. High and rising economic costs of biological invasions worldwide. *Nature*, 592, 571-576.

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

4. Genovesi P. & C. Shine. 2011. European Strategy on Invasive Alien Species. *Nature and Environment*, No. 161. Council of Europe.

### BOX 1. EU Regulation 1143/2014 on Invasive Alien Species

Regulation (EU) No 1143/2014 on the prevention and management of the introduction and spread of invasive alien species (the IAS EU Regulation) entered into force on 1 January 2015. It aims to: (i) prevent, minimise and mitigate the adverse impacts of IAS on biodiversity and ecosystem services; and (ii) limit social and economic damage.

The adoption of the IAS EU Regulation was a major step forward in developing the EU's biodiversity policy, adopting it fulfilled both: (1) Action 16 of Target 5 of the EU biodiversity strategy to 2020; and (2) Aichi Target 9 of the strategic plan for biodiversity 2011-2020 under the Convention on Biological Diversity.

The core of the IAS EU Regulation is the **list of invasive alien species of Union concern** (the Union list), together with a set of measures on these to be taken across the EU. Three types of measures are foreseen, following an internationally agreed hierarchical approach to combat IAS:

- Prevention
- Early detection and rapid response (EWRR)
- Management

### Why Strategic Recommendations for the transnational management?

Because IAS are a global threat, unilateral action by each country is not enough to prevent new introductions and to mitigate their impacts. Cooperation at international, regional and transboundary levels is essential to develop compatible approaches. Thus, the need for regional approaches at biogeographical levels has long been recognised by EU institutions.

Under the IAS EU Regulation, Spain and Portugal must prevent the entry of alien species, contain their spread within their territories, implement effective EWRR mechanisms to detect new introductions and adopt management measures for IAS that are already established. The IAS EU Regulation has been transposed into Spanish and Portuguese legislations and is implemented by each national administration, with the Spanish IAS catalogue and the Portuguese National List of IAS being pivots in this Regulation (BOX 2). However, collaboration and partnership between administrative agencies, NGOs and other stakeholders in both MS should be encouraged and enhanced to achieve the objectives of the IAS EU Regulation.

Spain and Portugal face similar constraints in their IAS management efforts.

These may include:

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

The present *Strategic Recommendations for the Transnational Management* (hereafter referred to as the Strategic Recommendations) addresses some of these constraints. Their aim is to promote the coordinated management between Spain and Portugal, in order to facilitate implementation of international commitments and best practices and to support development of policies, measures and targets on IAS management.

## BOX 2. Relevant normative in Spanish and Portuguese IAS Regulations

### SPAIN

- Law No. 42/2007 on Natural Heritage and Biodiversity.
- Royal Decree No. 630/2013 that presents the Spanish Catalogue of IAS, and subsequent updates.
- Royal Decree No. 570/2020 regulating the administrative procedure for the prior authorisation of the importation into the national territory of allochthonous species in order to preserve Spanish native biodiversity, which presents the Spanish Allochthonous list.

### PORTUGAL

- Law No. 50/2006 as amended, on Environmental Administrative Offences.
- Resolution of the Council of Ministers No. 55/2018 that approved the National Strategy for Nature Conservation and Biodiversity for 2030 (ENCNB 2030).
- Decree-Law 92/2019 that presents the National List of Invasive Species.

## Objectives of the Technical report

This technical report is designed to serve as a guiding tool to identify a strategic direction for the Spanish and Portuguese IAS governance that is already being developed at the regional and national level. Its geographical scope encompasses the continental areas of the two EU Member States: Spain and Portugal.

The Strategic Recommendations intends to be useful to improve the transnational response capacity to deal with invasive alien crayfish and crabs (ICC) in the fresh and estuarine waters of the Iberian Peninsula. A total of 16 taxa of crayfish and crabs (Order: Decapoda) are registered in the updated List of Aquatic Alien Species of the Iberian Peninsula, 8 of them prioritised in a black or concern list developed by LIFE INVASAQUA (Appendix A). Additionally, another 8 taxa were included in the PRIORITISED list of potential taxa that have not been yet recorded in the inland waters of the Iberian Peninsula but they have a high risk of invasion in the near future (Appendix A).

Therefore, the Strategic Recommendations are primarily aimed at improving EWRR systems to deal with ICC in complement to the existing IAS management framework, by providing guidance to help Spain and Portugal in their effort to:

- Strengthen transnational capacity and cooperation on ICC issues.
- Prioritise and identify key actions.
- Prevent new invasions and spread.
- Mitigate the adverse impacts and restoration of habitats as a mean of controlling ICC.
- Develop applied research on ICC.
- Increase awareness and information.

The technical report must be a dynamic tool that would evolve over time according to new situations or scenarios. It is also designed for a participatory process with agency managers and other stakeholders.

Finally, it should be noted that one of the objectives of LIFE INVASAQUA, and thus of their technical reports, is to promote collaboration with decision-makers and stakeholders and ensure information sharing and exchange.



## To whom are the Strategic Recommendations addressed?

This technical report is a guiding tool mainly addressed to nature conservation administrative agencies and other sectorial agencies with responsibility on IAS issues. It is recognised that many aspects of implementation should be delivered through existing administrative agencies which have long-standing expertise in particular management areas.

The Strategic Recommendations also seek to engage the general public and stakeholders (BOX 3) involved in the introduction, translocation, use and management of ICC and to build on the expertise and commitment of non-governmental organisations and research institutions. Many of the recommendations call for joint or complementary initiatives by both private and public stakeholders.

### **BOX 3. Public and private stakeholders**

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

Examples of public and private stakeholders involved in IAS are:

- Administrative agencies: wildlife managers, protected area managers, surveillance agents, customs and quarantine services, wildlife trade personnel, water resource managers, and other government departments (national and regional) responsible for agriculture and forestry.
- Professional associations for aquaculture/mariculture, recreational fishing, commercial fishing, pet and animal retailers, ornamental fish and aquarium trade, bird breeding, tourism/travel, shipping, water sports, forestry, horticulture, botanic gardens, zoological parks and aquariums.
- Universities and research institutes.
- Environmental NGOs.
- Environmental educators and journalists.



Rusty crayfish (*Faxonius rusticus*) ©Premek Hamr

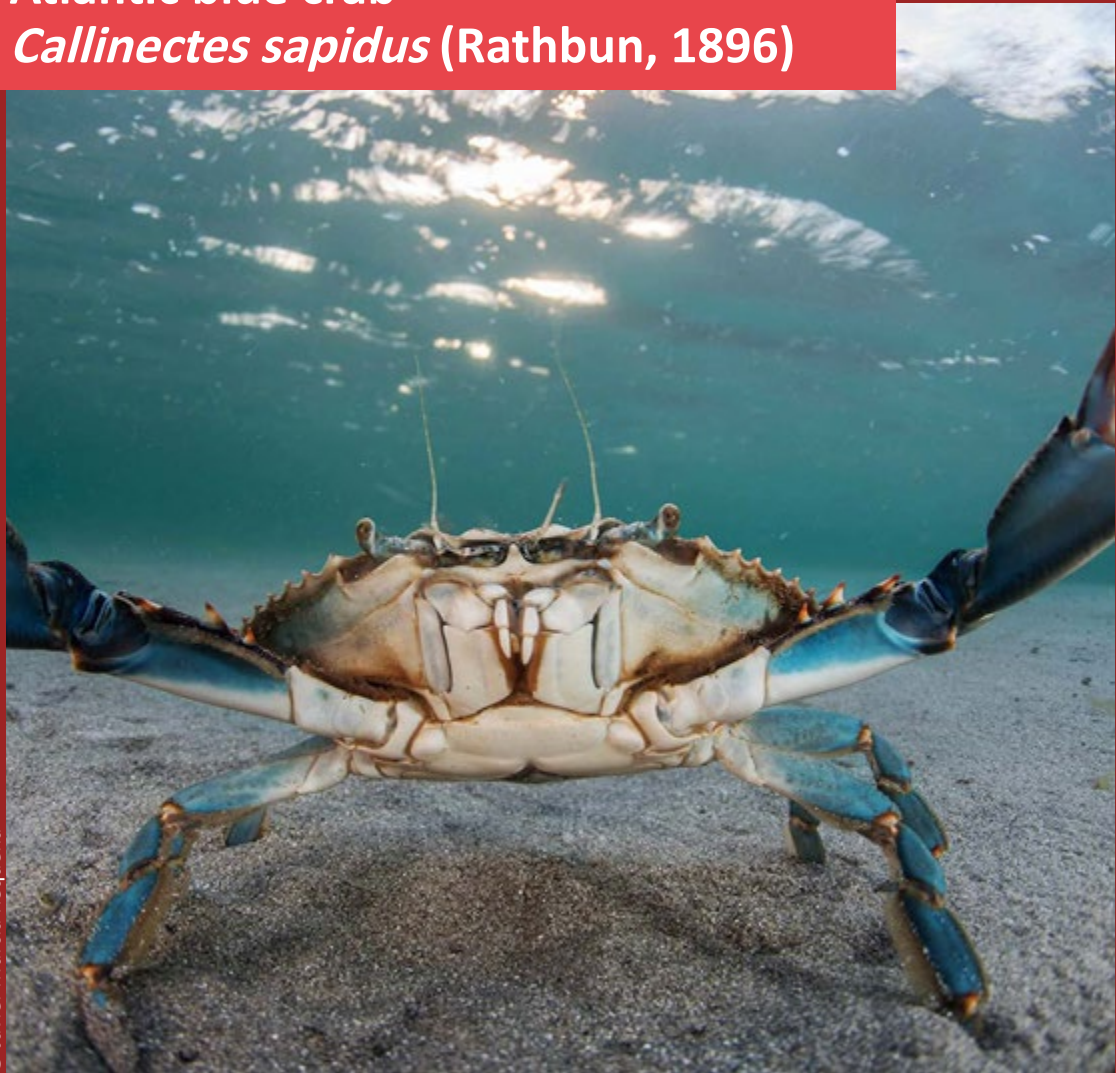
## Red swamp crayfish *Procambarus clarkii* (Girard, 1852)



© Luc Hoogenstein. CC-BY-SA-4.0

The red swamp crayfish is widespread throughout most of the river basins in the Iberian Peninsula, especially in the lower and medium reaches of rivers in the Southern part. This North American species was introduced into Spain in 1973 for aquaculture purposes. Since then, it has spread naturally within river basins but was also translocated by humans between river basins. Aside of its high activity within aquatic systems, it can easily move out of water and therefore colonise isolated water bodies. The red swamp crayfish currently has an intense associated trade for human consumption. However, it poses a threat to aquatic macroinvertebrates, amphibians and macrophytes but also has become a valuable food source for several aquatic predators which are now highly dependent on it. In rice fields, it became a pest due to its burrowing behaviour, which induces water loss and turbidity, but also because it consumes rice seeds and seedlings. Densities of 1 adult per m<sup>2</sup> at rice sowing can reduce rice production by 42% and 3 adults per m<sup>2</sup> 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.

## Atlantic blue crab *Callinectes sapidus* (Rathbun, 1896)



© Javier Murcia Requena

Native to the western Atlantic, from Nova Scotia in the United States to Argentina, this crab species is widely distributed outside its native range. In European Atlantic waters, the Atlantic blue crab was detected for the first time along the Atlantic coast of France in 1901. In the Mediterranean Sea, it was reported in the Aegean Sea as early as the 1930s. However, its arrival on the Iberian Peninsula dates back no more than 50 years and its rapid expansion is very recent. Accidental introductions of Atlantic blue crabs have been attributed mainly to the translocation of larvae via ships' ballast water. In addition, the natural dispersal of larvae along the Mediterranean coast may also have been a trigger for their rapid spread. Recent data suggest that the Atlantic blue crab populations present east and west of the Strait of Gibraltar are the product of a single invasion event into the Mediterranean Sea, with subsequent westward expansion or secondary introduction to other areas. This crab is found in a wide variety of habitats ranging from marine saltwater, being especially common in estuaries, and moving up into the fresh waters in rivers. It often uses estuaries to complete its life cycle and is a particularly successful invader of marine and estuarine ecosystems, because of its high fecundity and larval survivability, broad environmental tolerance, large body size, aggressive behavior, omnivorous diet, and strong swimming ability. Its omnivorous diet causes burgeoning impacts on macroinvertebrate diversity as well as almost any vegetable or animal matter, but also in fisheries. Monetary costs are expected to be high, although more effort in reporting is needed.

## Marbled crayfish

*Procambarus virginalis* (Lyko, 2017)



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The marbled crayfish is one of the most popular crayfish in the world pet trade in recent years. In fact, this crayfish was first discovered in the German pet trade in the mid-1990s. The species seems to be related to *Procambarus fallax*, which is distributed throughout the Florida peninsula in North America, but the marbled crayfish origin is yet unknown. This species is characterised by its conspicuous colour pattern (like marble) and its parthenogenetic reproduction, which allows for offspring to be produced from a single individual (all females) without the need of male fecundation. This reproductive capacity makes it a potentially harmful 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, the first wild individuals 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 China and Japan. In some countries as Madagascar, wild populations of the marbled crayfish have grown rapidly, becoming a severe threat for freshwater ecosystems and native biodiversity, but also being part of the current socio-economy of this country. The main economic impacts are related to rice culture and inland fisheries. Besides, marbled crayfish competes with native crayfish and can transmit crayfish plague pathogen, *Aphanomyces astaci*, which infects native crayfish, causing high levels of mortality on infected populations. This species has recently been recorded in aquatic systems in northern Spain, however, its establishment is not confirmed yet.

## Blue swimming crab *Portunus segnis* (Forskål, 1775)



© Enrique González Ortegon

The blue swimming crab is native to the western Indian Ocean, including the Red Sea and the Persian Gulf. During the late 19th century, this portunid crab entered the Mediterranean Sea through the Suez Canal and subsequently colonized a significant portion of the eastern Mediterranean coast. Additional records along the Tunisian coasts have demonstrated the rapid colonization of this species there and other regions within the Mediterranean Sea. Its high invasiveness makes this crab species to reach recently the coasts of the Iberian Peninsula in the near future. In fact, the blue swimmer crab *Portunus segnis* was detected for the first time in southwestern Atlantic European waters, specifically at the mouth of the Guadalquivir estuary, Gulf of Cadiz. In its introduce range, this species has the potential to threat biodiversity due to its omnivorous feeding habits and opportunistic predatory behaviour. However, despite these potential impacts, it could also represent a valuable fishery resource where it inhabits. The duality between its potential impacts and its use as fishery resource makes the management of this species complex. Regarding the ecological and biological characteristics of the blue swimming crab, it typically inhabits littoral areas with a preference for shallow waters, various substrate types, and occasional presence in estuaries. It can be found in a wide range of inshore and inland continental waters. The breeding season of this species extends throughout the year, with exception of winter, and spawning is influenced by seasonal changes in sea surface temperature, occurring at different periods of the year.

A close-up photograph of a signal crayfish (Pacifastacus leniusculus) in shallow water. The crayfish is brown and has its large claws extended. The water is clear, and the background shows a rocky riverbed with some green leaves.

2

**Strategic  
recommendations  
Lines of action**

The Strategic Recommendations, which are key in terms of time and feasibility of implementation, are structured in seven lines of action that do not present any order of priority.

The lines of action are broadly similar to those included in the European Strategy on Invasive Alien Species by the Council of Europe. Moreover, as a whole, these lines share several principles: (1) Scientific basis; (2) Synergy and partnerships; (3) Capacity, procedural streamlining and long-term commitment; and (4) Awareness, communication and education.

<b>Line of Action 1.</b>	STRENGTHENING INSTITUTIONAL AND LEGAL FRAMEWORKS FOR TRANSNATIONAL COOPERATION.
<b>Line of Action 2.</b>	UPDATING, SHARING AND TRANSFER OF INFORMATION.
<b>Line of Action 3.</b>	PREVENTION, SURVEILLANCE, EARLY WARNING AND RAPID RESPONSE.
<b>Line of Action 4.</b>	MONITORING, CONTAINMENT, CONTROL AND ERADICATION.
<b>Line of Action 5.</b>	ENVIRONMENTAL RESTORATION AND HABITAT MANAGEMENT.
<b>Line of Action 6.</b>	APPLIED RESEARCH TO IMPROVE MANAGEMENT CAPACITY.
<b>Line of Action 7.</b>	ENGAGEMENT OF STAKEHOLDERS AND AWARENESS OF THE GENERAL PUBLIC.

### **Line of Action 1 STRENGTHENING INSTITUTIONAL AND LEGAL FRAMEWORKS FOR TRANSNATIONAL COOPERATION**

#### **Aim & Objectives**

Improve the legal and institutional framework by coordinating and unifying efforts among ICC stakeholders to develop and strengthen relationships and to promote more effective management and governance strategies at the transnational level.

- Strengthening and promoting a Spanish-Portuguese strategy towards consensual decision-making through transnational agreements and coordination figures among administrative agencies.
- Identifying gaps and inconsistencies in legal framework by promoting the participation of administrative agencies and stakeholders in the improvement of legislation providing more flexible and adaptive context-dependence solutions.
- Harmonising regulation and lines of action related to ICC management between national and regional administrative agencies.
- Identifying, clarifying and coordinating competencies, roles and responsibilities among government authorities and administrative agencies directly involved in ICC management (i.e. environmental and wildlife management). In turn, encouraging coordination among agencies with responsibility in human and animal health, transport, tourism, trade, aquaculture and fishing, protected areas, urban water supply, irrigation and agriculture, and other fields relevant to management of ICC.
- Update regulation and standards in pet/aquaria shops and e-commerce, fostering enforcement of normative and prevention of the trade of ICC.

#### **Recommended actions.**

1.1. Collaboration among administrative agencies responsible for environmental and wildlife management, through a consultative process, for the development of a **Transnational Action Plan of ICC (ICC-TAP)** (BOX 4) to be incorporated into National and European Biodiversity Strategies and other relevant policies. The ICC-TAP must **update and incorporate the information from regional or national action plans**<sup>5</sup> that may be in force.

5. e.g. *Plano de ação nacional para o controlo do lagostim-vermelho-da-luisiana em Portugal continental*. 2021. Resolução de Conselho de Ministros n.º 133/2021, de 7 de setembro.



1.2. Developing a **Transnational IAS coordination office (IAS-Office)** for coordinating national IAS-related authorities, as well as supervising the efforts of administrative agencies to facilitate decision-making. An **Iberian Working-Group for ICC (ICC-WG)**, which could be made up of existing groups, should be key for advising the IAS-Office (BOX 5).

1.3. Establishing a **transnational organogram of roles and responsibilities**, by the IAS-Office, to clearly assign the administrative agencies involved in the enforcement and implementation of the ICC-TAP. **Regular work-meetings** among agencies will be essential.

1.4. Promoting **cross-sectorial collaboration** among administrative agencies to establish linkages between transnational programmes and focal points on the IAS management. For instance, **cooperation programmes** between the agencies that manage the main pathways and vectors of ICC (e.g. ballast water, aquarium trade, aquaculture) coordinating the different administrative agencies if it affects different territories and, therefore, different levels of management (coastal and inland waters).

1.5. **Identify key stakeholders and promote their participation** in, for instance, looking for a consensual set of inter-administrative regulations for ICC in order to avoid obstacles or contradictions across legal and administrative boundaries.

1.6. Initiate a **transnational review of existing measures and non-statutory procedures to manage the transport, trade and possession of ICC**, in order to produce practical recommendations and help administrative agencies set priorities. The **review of regulatory transnational measures at the border-cross level** for human activities with potential for introduction of ICC (e.g. aquarium trade, aquaculture, commercial fishing) should be priority.

1.7. Develop and enforce coordinated **action sub-plans for protected areas in cross-border regions** (e.g. for special conservation areas) in Spain and Portugal to address ICC, integrating awareness and communication efforts, regulatory measures, prevention aspects, as well as management actions.

#### **BOX 4. General elements of a Transnational Action Plan of ICC.**

- Status, trends, and specific problems of ICC in the Iberian Peninsula (Spain and Portugal).
- Main pathways, vectors and particular risks.
- Details of national IAS authority/network.
- Roles and responsibilities of key administrative agencies.
- Relevant legislation, non-statutory measures, and proposals for improved prevention and management.
- Outline of criteria for risk analysis, management planning and mitigation.
- Needs related to monitoring, training, capacity building and funding.
- Specific measures or policies for isolated and/or ecologically sensitive ecosystems (e.g. protected areas).
- Priority list of actions, timelines and lead administrative agencies and stakeholders for implementation, with realistic targets to be achieved.
- Establishment of a mechanism to exchange information and collaborate with other countries.

#### **BOX 5. Possible roles of a Transnational IAS coordination office (IAS-Office).**

- Lead and coordinate the development and implementation of strategies and action plans on IAS (e.g. proposed ICC-TAP).
- Lead and coordinate the institutional and legal review process.
- Coordinate input from different administrative agencies to national and European policy programmes.
- Consult with competent scientific and technical authorities to obtain technical advice on decision making related to ICC, with the Iberian ICC-WG being a key element.
- Engage with stakeholders and relevant sectors to raise awareness campaigns and encourage best practices.

## Line of Action 2

### UPDATING, SHARING AND TRANSFER OF INFORMATION

#### Aim & Objectives

- Promoting transnational exchange to unify and address information on ICC issues (e.g. biological/ecological data, management techniques) in order to rapidly make available the most up-to-date and effective measures for their management.
- Identifying requirements and strengthening agreements for Spanish-Portuguese exchange of information, promoting use of terminology consistent with the IAS EU Regulation, with a common interpretation of key terms and concepts.
- Engaging and creating synergies between knowledge building and different stakeholders.
- Gathering, centralising and updating information related to the ICC management in each responsible administrative agency (national and regional).
- Encouraging the exchange and sharing of mechanisms for best-practices, eradication techniques and knowledge among national and regional administrative agencies.

#### Recommended actions

2.1. Establish a **general procedure for transnational and intra-State information exchange, notification and consultation** (e.g. information-exchange protocols) of the main elements involved in the ICC-TAP (action 1.1). Transnational documents, web platforms and other mechanisms of information exchange should be in a multilingual format (at least Spanish, Portuguese and English).

2.2. Develop mechanism to strength links between policy makers, administrative agencies, scientific groups from different fields (e.g. ecology, economy, sociology), and other stakeholders. For instance, developing links between **knowledge-exchange programmes** on ICC (action 6.2) and administrative agencies to identify key requirements facilitating the creation of **collaborative networks** (action 6.2).

2.3. Organizing periodic **workshops and forums** coordinated by the IAS-Office and ICC-WG in collaboration with scientific societies to discuss solutions among stakeholders.

2.4. Develop and maintain a **user-friendly online platform/website** (e.g. [Aquatic Invasive Alien Species of the Iberian Peninsula platform](#); [IBERMIS platform](#)) or other system of linked regional, national and transnational information on ICC management (e.g. established and potential species, occurrence in the wild, priority eradication actions, basic guidelines for citizens). This system should set data standards and facilitate the sharing of data in multiple languages (at least in the official languages of Spain and Portugal). **Technical review-reports** (action 6.2) must be available for download in this platform.

2.5. **Reporting innovative, cost-effective and non-invasive sampling protocols** for early detection, eradication and control of ICC. **Workshops and forums** (action 2.3) will assure the transfer of the most up to date methods for management.

2.6. Encouraging the development of **best-practices and codes of conduct to aquarium shops/aquarium trade and aquaculture/astaciculture facilities** for avoiding the risks associated with release and escape of ICC into the wild.

## Line of Action 3

### PREVENTION, SURVEILLANCE, EARLY WARNING AND RAPID RESPONSE

#### Aims & Objectives

To prevent and minimise the introduction and the spread of ICC through an approach prioritising pathways and vectors of arrival.

- Applying prevention and surveillance efforts to key private stakeholders that generate intentional and unintentional introductions, as well as to high-risk entry sites (e.g. locations next to aquaculture farms in estuaries and rivers) and natural dispersal pathways (e.g. water systems in cross-border regions or shared watersheds).
- Increasing the EWRR system efficiency for surveillance cross-border regions (also in-State themselves) and to conduct rapid response actions. Updating information, maximising the use of existing capacity, disseminating advantages of new technologies, and training field surveillance agents.
- Implementing site-based actions to complement prevention and surveillance targets at spatial scales, from global to regional, and down to specific areas (e.g. protected areas).

#### Recommended actions

3.1. The ICC-TAP (action 1.1) **must update and incorporate the information from the national action plans on the pathways of introduction and spread of IAS<sup>6</sup>** considering prevention and surveillance strategies at the Iberian and cross-border levels.

3.2. Developing **contingency sub-plans** (e.g. cross-border contingency plans), included in the ICC-TAP, ensuring funds, equipment, and staff, to prevent the arrival of new ICC. For instance, build agreement and communication strategies between customs at airports and ports and administrative agencies (e.g. IAS-Office) to address weaknesses, to strength control best techniques for detection and to implement staff training and capacity-building programmes.

3.3. Monitor compliance with the International Convention for the Control and Management of Ship's Ballast Water and Sediments by promoting a **sampling and inspection program in port areas** including estuaries or rivers. Port authorities and concessionaires of marinas in inland waters should be involved.

3.4. Coordinate by IAS-Office, developing and updating a **transnational agreed listing system** (BOX 6) and subsequently propose transfer to the regulatory lists.

3.5. Coordinated by the ICC-WG, **applying a periodical horizon scanning** to guide efforts in rapid risk assessments, to update the **alert list** (BOX 6) for potential new ICC, and to identify new pathways.

3.6. **Adapt licensing rules for prevention and containment facilities** to minimise risk arising from escape and release of ICC. Target facilities may include aquaculture farms, public aquaria, and animal retail establishments.

3.7. Develop **projection models of environmental suitability for established ICC** that can for instance define key sentinel areas and set monitoring for early detection, thus increasing the efficiency of spreading control.

3.8. Establishing and monitoring an **early warning and surveillance network on high-risk inland waters** most vulnerable to new invasions of ICC at regional scale (e.g. at watershed level) and also in protected areas (e.g. special areas of conservation). Protocols with standardised sampling techniques are needed to detect first introductions and spread of ICC within and across river basins (e.g. environmental DNA).

6. e.g. *Action Plan on the pathways of introduction and spread of invasive alien species in Spain. 2021. Coordinated by General Directorate for Biodiversity, Forest and Desertification. Ministry for Ecological Transition and the Demographic Challenge. Spain.*

3.9. **Training personnel involved** in surveillance, early warning and rapid response to conduct site- and taxa-specific surveys (e.g. courses and practical identification guides for ICC).

3.10. **Enhancing the use of citizen science applications** (e.g. the *Invasive Alien Species in Europe App*<sup>7</sup>) for prevention and surveillance.

3.11. Complement a **transnational agreed listing system** (action 3.4.) developing a **white list** of ICC (BOX 6) to facilitate screening of permit applications for indoor facilities.

#### BOX 6. Possible components of a transnational agreed listing system

The Spanish and Portuguese IAS Regulation already include lists in normative that can be the basis for a transnational agreed listing system: Spanish IAS Catalogue, Portuguese National List of IAS and Spanish Allochthonous List.

- **Alert list:** Alien species not yet present in a territory or present only in introduction stage that pose invasion risks to the invaded areas and for which particular prevention, surveillance and monitoring efforts are recommended, in order to enhance prompt response in the case of entry into the wild and spread. The list shall be updated and transferred to the competent authorities.
- **Black list:** Species whose introduction is strictly regulated, and that according to a specific risk assessment pose risks to the environment, economy or human well-being. Priority should go to: (1) species already identified as highly invasive in MS and species proven to be invasive in other Mediterranean regions; (2) species that are likely to cause problems to several MS and have a high potential of introduction; (3) species that are likely to be a problem in several MS, which are not yet present but are likely to be introduced.
- **White list:** Species classified as low risk following a specific risk assessment. This list includes exotic taxa known on the basis of stringent criteria to have such a low probability of invasion that they can be commercialized. The use of white lists should not prevent the preferential use of native species of local provenance where appropriate. It is recommended to involve stakeholders in the acceptance of the white list.

The listing system should be dynamic, making it possible to transfer species among lists if justified (e.g. for white-listed species in trade over a long period, the risk should be reassessed if there is new evidence of invasive behaviour). Species listing and decision-making need to be based on scientific criteria that are periodically reviewed.

Terminology adapted from:

Genovesi P. and D. Shine. 2011. *European Strategy on Invasive Alien Species*. Nature and Environment, No. 161. Council of Europe; European Environment Agency. 2010. *Towards an early warning and information system for invasive alien species (IAS) threatening biodiversity in Europe*. European Environment Agency, Technical report, num 5.

7. Joint Research Center. 2022. *Invasive Alien Species in Europe*. Version 5.1.0. JRC Scientific Information Systems and Databases. European Commission.

## Line of Action 4

### MONITORING, CONTAINMENT, CONTROL AND ERADICATION

#### Aim & Objectives

Improve the management framework providing administrative agencies and stakeholders with best tools for appropriate monitoring and actions to mitigate impacts of established ICC.

- Develop lists of established ICC and priority action sites, as up-to-date and dynamic as possible, with practical guidelines on how to improve management actions.
- Evaluate costs associated with ICC management projects (containment/control/eradication) using both cost benefit and cost effectiveness analyses.
- Engage relevant stakeholders in monitoring and management actions.

#### Recommended actions

4.1 Updating lists of priority established ICC to contain, control or eradicate (e.g. **black list**) following the **transnational agreed listing system** (action 3.4) (BOX 6) that contemplates the space-time context necessary to mitigate impacts (e.g. extension of the invaded area) and increase the success of management actions at the population level.

4.2 Establishing a **network of transnational focal sites for management actions** on priority ICC populations, based on potential spread, degree of disturbance, feasibility, and success of measures.

4.3 Implement management **pilot projects in transnational focal sites**, with coordinated aims, appropriate arrangements and if possible with **high visibility** (action 7.3).

4.4 Maximise the **contribution of relevant stakeholders** to monitoring and management actions. For instance, extending responsibility to prevent and control spread of ICC (e.g. notification of listed ICC on holdings, farms, and fishing grounds).

4.5 **Gathering information on priority ICC containment/control/eradication techniques** to enable site-specific assessments of the type of management to be carried out quickly and efficiently (BOX 7).

4.6 Environmental agencies should require **rapid risk assessments of ICC spreading in projects for the construction of canals and water transfers**, especially those connecting watersheds. This should be requested for projects related to water pumping and irrigation systems, or dredging.

4.7 Require adequate **monitoring of results in ICC containment/control/eradication projects**. This should serve both to adaptive management plans against non-containment or re-colonization, and to transfer lessons learned to new projects.

4.8 Provide funding for research (action 6.3) and development of **novel containment/control/eradication methods** (e.g. pilot projects of genetic control, containment devices, and efficient humane dispatching methods).

### **BOX 7. Several criteria for eradication actions**

The **eradication** is a complete removal of all individuals in a population of an alien species. When carried out successfully, it is more cost-effective than other management actions (i.e. control, containment, do-nothing) than other management actions (i.e. control, containment, do nothing). However, eradication of these organisms is rarely achieved, success events have been reported in small streams, small or urban ponds.

#### **CONDITIONS FOR ERADICATION**

- There are adequate public support, sufficient funding and political commitment.
- The eradication is feasible. Feasibility should be assessed on the basis of relevant biological characteristics of the target ICC, its ecological relationship with the invaded area and socio-economic considerations.

#### **PRIORITY SPECIES FOR ERADICATION**

- Newly-arrived ICC, especially if non-reversible effects are predicted.
- Species representing a major threat to biodiversity.
- Species already established, but whose effects on invaded ecosystems are reversible.
- Species for which eradication is most feasible.

#### **DESIGN OF ERADICATION ACTIONS**

- Consider impacts, reversibility of effects and risk of re-invasion of the management area.
- A pilot eradication project can be designed to collect information for the assessment (e.g. risk for non-target species and ways to minimise it), determine the chances of success and address worst case scenarios.
- Select eradication methods primarily on the basis of their efficiency (e.g. methods should reduce population size below the threshold of future viability).
- Methods should be as selective and ethical as possible and comply with applicable regulations (e.g. animal welfare).
- Monitor effort, costs and results to allow for corrections and identify means to prevent future re-invasions.

## Line of Action 5

### ENVIRONMENTAL RESTORATION AND HABITAT MANAGEMENT

#### Aim & Objectives

Develop methods for the restoration and rehabilitation of aquatic and riverine habitats that prevent introduction, spread and establishment of ICC and support recovery of the conservation status of invaded areas.

- National policies and strategies for the restoration/rehabilitation of aquatic ecosystems<sup>8</sup> need to take account of invasion risk of ICC and promote ecologically sound practices to minimise their introduction, spread and establishment, and also to remedy their impacts.
- Adequate monitoring of the results of restoration/rehabilitation projects. This should serve both to design adaptive management and to transfer lessons learned, thereby increasing the effectiveness of restoration in the face of new invasions.

#### Recommended actions

5.1. Develop integrative and comprehensive **protocols for the diagnosis of the level of impacts of ICC** on biodiversity and ecosystem services **and protocols for the assessment of effectiveness of restoration/rehabilitation measures**.

5.2. **Implement integration mechanisms for stakeholders** (e.g. commercial fishing associations, aquaculture associations, irrigation associations) involved in restoration/rehabilitation projects.

5.3. Encourage the development of **best-practices and codes of conduct to environmental restoration agencies, NGOs or companies** to expose the risk of restoration/rehabilitation procedures in areas invaded by ICC (e.g. earthworks, inspection and cleaning of machinery).

5.4. **Promote adequate environmental flows and recovery of natural flow regimes** in the restoration/rehabilitation projects in fluvial ecosystems to prevent introduction, spread and establishment of ICC.

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8. e.g. *National Strategy for River Restoration*. 2010. Ministry of the Environment and Rural and Marine Affairs. Spain.

## Line of Action 6

### APPLIED RESEARCH TO IMPROVE MANAGEMENT CAPACITY

#### Aims & Objectives

To promote and foster scientific knowledge on ICC in order to develop tools that support institutional framework, improve forecasting, and make management more effective in inland and estuarine waters.

- Encouraging integrative, multi- and inter-disciplinary approaches in research applied to the management of ICC (e.g. biological, social, economic sciences).
- Involving academic research institutions and societies on IAS issues, and enhance the creation of collaborative networks at Iberian scale.
- Designing and proposing mechanisms that prioritize research to improve prevention and mitigation of impacts of ICC.
- Fostering innovative techniques for the eradication, control and monitoring of ICC.

#### Recommended actions

6.1. Incorporating **applied research on ICC management into the scientific-technical priorities** of the national governments operational planning tools (e.g. State Plans for Scientific and Technical Research and Innovation which include funds planned schedule for R&D&I).

6.2. Promoting the development of **knowledge-exchange programmes** on ICC between research institutions and scientific societies including **collaborative networks** (e.g. [InvaNET](#)) with managers to **develop pilot studies** to improve control and eradication techniques.

6.3. **Directing research resources** towards applied approaches addressing priority topics on ICC management (BOX 8). This will be a dynamic process, and will follow updates in data and knowledge.

6.4. **Technical review-reports** of the status of ICC in the Iberian Peninsula would be advisable periodically, including updated lists of species, distribution maps, and scientific-based guidance on management methods. These reports should support the integration of data into the [European Alien Species Information Network \(EASIN\)](#)<sup>9</sup>.

#### BOX 8. Examples of research priorities

- Risk analysis to assess species and identify management tools to prevent and reduce their entry and dispersal through specific pathways and vectors (e.g. ballast water, aquarium trade, water transfers, canalization).
- Models to predict the distribution and spread of target ICC (e.g. distribution models based on species occurrences and environmental variables, including for instance climate projections).
- Effective techniques to detect newly introduced ICC (e.g. environmental DNA).
- Effective techniques to detect co-introduced taxa (defined as parasites as those which have been transported with an alien host to a new locality, outside of their natural range) and co-invading taxa (parasites as those which have been co-introduced and then spread to new, native hosts).
- New mechanical, chemical and biological approaches in population control and eradication (e.g. biocontrol, genetic control, species-specific toxins, pheromones traps, etc.), to be integrated and combined in management protocols.
- Assessment of the ICC impacts on biodiversity, economy, and public health, as well as their implications for human well-being and society.
- Evaluate and prioritise mitigation measures according to feasibility, effectiveness and cost-benefit.

9. European Commission - Joint Research Centre - European Alien Species Information Network (EASIN).



## Line of Action 7

### ENGAGEMENT OF STAKEHOLDERS AND AWARENESS OF THE GENERAL PUBLIC

#### Aims & Objectives

Build public awareness and commitment of key stakeholders for making ICC a priority issue, leading to greater support of on-going actions and pro-active participation in the solutions.

- Identifying the main interests and roles of key stakeholders (e.g. aquaculture associations, recreational and commercial fishing associations, aquarium associations and trade) (BOX 3) to engage them in shared solutions linked to the ICC-TAP (e.g. adoption of best-practices and codes of conduct).
- Developing awareness-raising, environmental education and information campaigns to gain the general support of different audiences, incorporating communication methods that avoid contradictions (e.g. making information easily understandable, and widely accessible in several languages).

#### Recommended actions

7.1. Develop **awareness raising campaigns directed to key stakeholders** (e.g. aquarium trade and aquaculture). Develop partnerships with stakeholders to disseminate information and to implement the use of **best-practices and codes of conduct in the aquarium shops and trade, in the aquaculture facilities, and in the recreational fishing** (action 2.6).

7.2. Implement **awareness raising campaigns to education and communication groups**. Manuals of best-practices for knowledge multipliers (e.g. museums, aquariums), environmental educators, and environmental journalists, among other groups, are useful tools.

7.3. Use **appropriate pilot management projects on ICC** (action 6.2) **with high visibility** as a basis for raising public awareness, validating investment in specific measures, and building capacity through *learning by doing*.

7.4. Develop and implement **multidisciplinary approaches to prevent and minimise social conflicts** (e.g. with recreational and professional fishermen) so that social support for ICC management is not deteriorated.

7.5. **Enhance the use of citizen science applications** (e.g. *Invasive Alien Species in Europe* App) to inform on ICC and to raise awareness in severely impacted areas.

7.6. Establish **co-management committees in areas invaded by ICC** where there are associated socio-economic activities, to reach agreements involving stakeholders. For instance, professional fishermen should be involved in the management of target ICC by establishing trade-offs between sustainable exploitation and containment specific measures.



Virile crayfish (*Faxonius virilis*) © Premek Hamr



Atlantic blue crab (*Callinectes sapidus*) © Javier Murcia Requena

# Terminology

**Administrative agencies:** Governance authorities, institutions and services at national, regional or local scales.

**Alien Species:** Animals, plants, fungi or microorganisms introduced outside their natural ranges; 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 (Regulation (EU) No 1143/2014). Common synonyms for alien species are: exotic, introduced, non-indigenous, or non-native species.

**Containment:** Actions aiming to limit spread and restrict alien species within regional barriers in a defined area. This action is particularly appropriate where the range of the introduced population is small enough to achieve a significant result. This should be considered a high priority action for IAS that could spread through cross-border areas and- into ecologically vulnerable areas.

**Control:** Actions aiming to reduce the density and abundance of an alien species population to keep its impact below an acceptable threshold. Effective control should be considered on the basis of cost/benefit analysis and may be achieved through a range of integrated management techniques (e.g. mechanical, chemical and biological).

**Early warning and rapid response (EWRR):** A framework designed to respond to biological invasions through a coordinated system of surveillance and monitoring actions; diagnosis and assessment of risks; circulation of information; and enforcement of appropriate responses.

**Eradication:** Complete removal of all individuals of a population of an alien species. Eradication is considered to be feasible in the early stages of invasion when populations are small and localised, and only in areas of manageable size (e.g. small water bodies, isolated small streams) which should be priority areas for this action.

**Invasive Alien Species (IAS):** Alien species whose introduction or spread has been found to threaten or adversely impact upon biodiversity and ecosystem services (Regulation (EU) No 1143/2014).

**Mitigation:** Management actions to reduce the severity of the impacts and related to eradication, containment and control of introduced and established alien species.

**Potential taxa:** Alien taxa not yet present in a territory but already present in transport or introduction invasion stage, or taxa occurring in nearby territories, with a high risk of invasion.

**Prevention:** Measures that will reduce the risk of arrival and establishment of alien species due to human assisted transport.

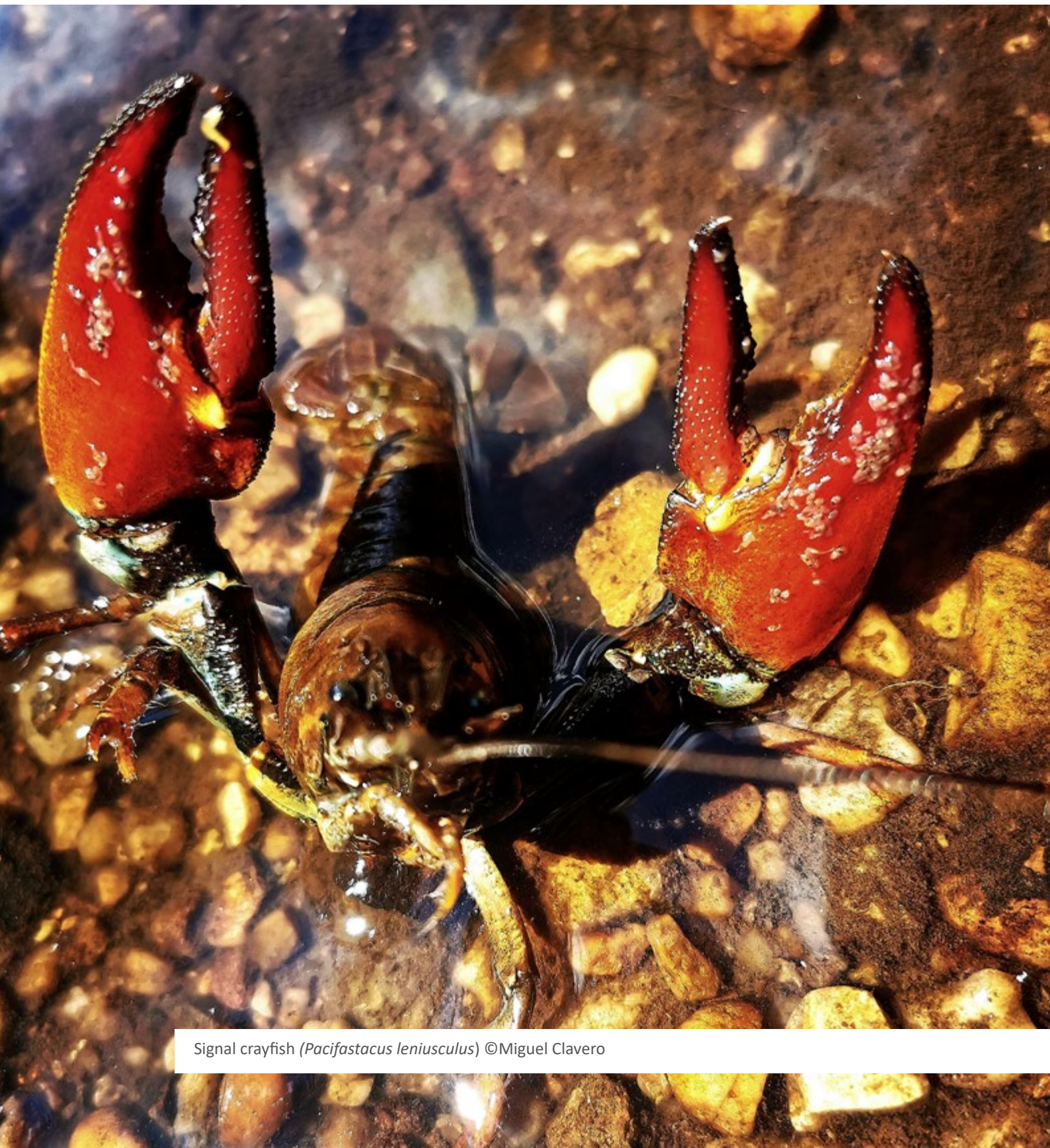
**Rapid response:** Management measures to tackle the potential impacts of alien species and invasive alien species that are implemented within a short period of time.

**Risk assessment:** Evaluation of the likelihood of introduction, establishment or spread of an alien species/taxon in a given territory, and of the associated potential biological and economic consequences, taking into account possible management options. Risk assessment includes risk analysis (process of evaluating biological or other scientific and economic evidence to determine whether an alien species will become invasive) and risk management (evaluation and selection of options to reduce the risk of introduction, establishment and spread of an invasive alien species).

**Stakeholders:** Individuals, groups and organizations that are actively involved in IAS issues or whose interests may be affected by IAS management.

**Transnational Action Plan:** A plan that addresses priority issues in a coordinated way and promotes Spanish-Portuguese approaches to shared problems. This must develop common frameworks between Spain and Portugal administrative agencies which consider possible management strategies contingent on the species that have or may be introduced or spread in inland and estuarine waters in the Iberian Peninsula. It is recommended that this plan specify the nature of the actions to be implemented, the timeframe, the key groups involved, the costs, and the funding sources.

**Transnational strategies/programmes:** Spanish-Portuguese strategies and programmes developed and implemented in a coordinated way.



Signal crayfish (*Pacifastacus leniusculus*) ©Miguel Clavero

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# Appendix A

## Alien crayfish and crabs included in the Black list and Alert list of the Aquatic Invasive Alien Species of the Iberian Peninsula<sup>10</sup>

List of invasive alien decapods registered in the Black list or in the Alert list and evaluated by experts. Taxa are ordered by score value (20 as maximum) reflecting risk of impact (for recorded taxa) and invasion (for potential taxa) to the Iberian inland waters.

Scientific name	Family	Score	Risk
<b>Black list</b>			
<i>Procambarus clarkii</i>	Cambaridae	18.67	Very-high
<i>Pacifastacus leniusculus</i>	Astacidae	17.33	Very-high
<i>Callinectes sapidus</i>	Portunidae	15.20	Very-high
<i>Eriocheir sinensis</i>	Varunidae	12.75	High
<i>Faxonius limosus</i>	Cambaridae	12.50	High
<i>Rhithropanopeus harrisi</i>	Panopeidae	12.50	High
<i>Cherax quadricarinatus</i>	Parastacidae	12.00	High
<i>Cherax destructor</i>	Parastacidae	11.67	High
<b>Alert list</b>			
<i>Procambarus virginalis</i>	Cambaridae	16.17	Very-high
<i>Faxonius rusticus</i>	Cambaridae	15.50	Very-high
<i>Faxonius virilis</i>	Cambaridae	15.17	Very-high
<i>Portunus segnis</i>	Portunidae	12.33	High
<i>Hemigrapsus aff. takanoi</i>	Varunidae	12.00	High
<i>Homarus americanus</i>	Nephropidae	11.67	High
<i>Cherax tenuimanus</i>	Parastacidae	9.80	Medium
<i>Potamon ibericum</i>	Potamidae	8.83	Medium

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

## Abstract

An important goal of LIFE INVASAQUA is to develop tools that will improve management and increase the efficiency of the Early Warning and Rapid Response framework for Invasive Alien Species (IAS) in the Iberian Peninsula. We developed a participative process with experts in order to obtain Strategic Recommendations for the transnational management of invasive alien crayfish and crabs in inland waters of Spain and Portugal. They promote the coordinated management between Spain and Portugal, in order to facilitate implementation of international commitments and best practices and to support development of policies and targets on IAS management at Iberian scale.

They were designed to serve as a guiding tool seeking to identify a strategic direction for the Spanish and Portuguese governance that is already being developed. The resulting Strategic Recommendations are important tools supporting the implementation of the IAS EU Regulation.

Ultimately, the information included can be used for achieving the target of the EU Biodiversity Strategy to 2030 for combating IAS, and also for implementing 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



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### Associated beneficiaries



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