Invasive Alien Species of the Segura river basin

Priority management lists

2019

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Priority management lists: implementation of A2 action of the LIFE + RIPISILVANATURA project

2019

Región de Murcia

Data sheet

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Abstract

During 2018 in the implementation of the A2 action of the LIFE + RIPISILVANATURA project, work-meetings with the participation of more than 30 experts and staff involved in the environmental management have been developed to elaborate priority lists of aquatic and riparian Invasive Alien Species (IAS) in the Segura River Basin. In the present work we summarize the results of this participative evaluation action that has been innovative because it comes to improve communication and discussion channels at a regional level. In addition, this action has combined the interest of the Environmental Administration to update priorities in the management and control of IAS with the collaborative work of experts.

Through the application of species selection criteria and the prioritization by experts, a priority list of IAS for the management in the Segura River Basin composed of a total of 47 taxa (27 fauna and 20 flora) has been obtained. In addition, the first alert list of IAS with invasive potential (115 taxa) has also been developed, which should be a basic tool when making decisions in the strategy against new invasions. This work has received the grant through the LIFE program (LIFE13 BIO / ES / 001407).

Key-words: *rivers, biological invasions, management, riverine habitats*.

Resumen

Durante 2018, en el contexto de implementación de la acción A2 del proyecto LIFE+ RIPISILVANATURA, se han realizado varias jornadas de trabajo con más de 30 expertos y personal implicado en la gestión para la realización de listas prioritarias de gestión de Especies Exóticas Invasoras (EEI) de carácter acuático y ripario en la cuenca del río Segura. En el presente trabajo se resumen los resultados obtenidos en esta acción de evaluación participativa que ha sido innovadora a la hora de facilitar canales de comunicación y discusión a nivel regional. Además, esta acción ha conjugado el interés de la Administración medioambiental por actualizar prioridades en materia de gestión y control de EEI con el trabajo colaborativo de expertos.

Mediante la aplicación de criterios de selección de especies y la priorización por grupos de expertos sobre un listado base de EEI establecidas, se ha obtenido el *Catálogo de EEI prioritarias para la gestión en la cuenca del río Segura* compuesto por un total de 47 taxones (27 fauna y 20 flora). Además, se ha elaborado una primera lista de alerta de EEI con potencial invasor (115 taxones) que debe ser una herramienta básica a la hora de la toma de decisiones en la estrategia preventiva ante nuevas invasiones. Este trabajo ha recibido la subvención a través del programa LIFE (LIFE13 BIO/ES/001407).

Palabras clave: *ríos, invasiones biológicas, gestión, riberas.*

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1. INTRODUCTION AND JUSTIFICATION: PROBLEM OF INVASIVE ALIEN SPECIES (IAS) IN AQUATIC SYSTEMS AND RIVER BASIN

1. INTRODUCTION AND JUSTIFICATION: PROBLEM OF INVASIVE ALIEN SPECIES (IAS) IN AQUATIC SYSTEMS AND RIVER BASIN.

Biodiversity faces numerous threats around the world. At present, scientists and specialists involved in environmental management recognize that invasions caused by invasive alien species (IAS) are one of the greatest dangers for biological diversity (Clavero and García-Berthou 2005, Vilà et al., 2008). The ecological impacts of IAS are numerous, of a high intensity and generally irreversible. On a global scale, they can be as detrimental to native species and ecosystems as degradation and habitat loss. In fact, they are currently considered a fundamental component of global ecological change (Early et al., 2016).

The introduction of species is one of the main causes of species reduction and extinction (Primack and Ros 2002). However, in many cases it is difficult to detect, quantify or establish evidence of the impacts of these IAS. This difficulty basically lies in the non-existence of data prior to the invasion and in the absence of continuous monitoring or monitoring programs. Although there are cases of introduced taxa that have no impact on their new ecosystems, the majority of established species exert significant ecological impacts which may have environmental, socioeconomic and health consequences (Capdevila et al., 2006 and 2011). In the context of the conservation and management of aquatic systems, it is very important to understand the magnitude and scope of the impacts of these invasive alien taxa.

In general terms, IAS change the composition of communities and reduce the abundance of native species through four main mechanisms (García-Berthou 2007): (1) hybridization and genetic alteration, (2) introduction of parasites and transmission of diseases, (3) trophic relationships and (4) changes at the ecosystem level. The effects of IAS as a whole can be so profound that they are able to alter the structure and functioning of entire ecosystems, threatening their ability to provide ecosystem services such as water regulation or flood control. It is also shown that the introduction of IAS can cause significant economic consequences related to the reduction of yields in fishing, agriculture or diverse recreational uses. In the case of aquatic systems, damages are also common in infrastructures related to irrigation or hydroelectric exploitation, the blockages that can cause in channeling and the loss of recreational spaces or cultural heritage. Additionally, certain IAS may be a problem of the first order for human health, since they can act as transmission vectors for dangerous diseases and pathogens, or they can cause dermatological problems and also trigger allergies with important effects on broad sections of society. The IAS are a very significant and growing problem in all European countries and the cost associated with their presence has been growing exponentially. In recent decades, it is estimated that the IAS have cost the European Union more than 12,000 million euros per year according to sources from the European Commission (European Union 2014).

The continental aquatic ecosystems, including their riparian habitats, are among the most intensely affected by the introduction of IAS (Chucherousset and Olden 2011, Gallardo et al., 2016). The degradation of these ecosystems

has caused exotic species to become established and become invasive more easily than in other environments. Many of the IAS are skillful colonizers that present a rapid adaptation in degraded aquatic or riparian habitats, among other aspects, characterized by communities with a reduction of competition between species that facilitates this adaptation. For example, in the case of their fish communities, the condition is particularly high (Gozlan et al., 2010, Leunda 2010). The patterns observed in the Iberian Peninsula with this faunal component are very disturbing (Clavero 2011), a large part of the established exotic invasive fish are expanding their distribution areas and, moreover, new introductions of taxa that had never been cited in our aquatic systems are described (Anastacio et al., 2019). Most of the river basins of the Iberian Mediterranean harbor more foreign species than native ones, with the Segura river basin being a prime example (Torralva et al., 2005, Oliva-Paterna et al., 2017 and 2019). Similar patterns present other very significant biological components in the dynamics of aquatic ecosystems such as several groups of invertebrates (molluscs, macrocrustaceans, etc.), macrophytes and other characteristic flora of our riverbanks (Dana et al., 2005, García-Berthou et al., 2007) , Vilà et al., 2008, Cobo et al., 2010).

The biological diversity currently present in the aquatic systems and riparian habitats of the Segura river basin reflects a remarkable degradation and loss of biotic integrity compared to historical data (Oliva-Paterna et al., 2014). The number of invasive alien species has increased significantly, the change in this community has been drastic in a period of less than 25 years, being even greater in certain fluvial sectors with biggest human impact and also in artificial systems (reservoirs and water irrigation ponds) that are optimal reservoirs for many IAS. Several species included in the Spanish Catalog of Invasive Alien Species (RD 630/2013) have been cited in recent decades (Miñano et al., 2002, Oliva-Paterna et al., 2005, 2014 and 2017, González-Wangüemert and Pujol 2016, Zamora-Marín et al., 2016 and 2018). However, there is a notable absence of information on the real and potential impacts that this exotic component is exerting at the regional level. The updated inventory of alien invasive taxa established in aquatic systems and riparian habitats is presented in this work, together with a list of potential species with a higher risk of future invasion (Alarm list). In addition, it is complemented by an updated review on the ecological impacts that these IAS may have on native diversity, on the most significant economic impacts and on the most important human health problems. This type of work aims to offer a necessary approach aimed at the development of tools in the management and conservation of regional biodiversity at the river basin scale (Capdevila et al., 2006, Dana et al., 2011).

In the long term, education, raising awareness and increasing the perception of the problem of IAS among citizens, stakeholders and social agents, as well as those responsible for management may be the most important contribution to reduce the entry of new species and effectively control biological invasions.

What role do the IAS priority lists have?

The preparation of priority IAS management lists is a necessary tool within strategic management actions (Capdevila et al., 2006). The type of lists presented in this paper are instruments that improve the regional framework for early warning and prompt response in the management that should be developed in the strategic management guidelines at river basin level. In addition, the prevention of the expansion of IAS channeled through human activities is dependent on the periodic updating of these lists and the field monitoring of localities established in early warning networks.

The priority lists of IAS at the river basin level fulfill several functions that must be integrated in the guidelines or strategies for the management, control and eradication of invasive species.

• Optimize the management prioritizing on focal IAS.
• Facilitate decision-making in sectors that are competent in management, both preventive and reactive through control actions.
• Constitute reference lists for all the sectors involved.
• Indicate surveillance priorities and trigger an early response mechanism in the case of introductions.

At present, there are lists of disturbing or unwanted species that are made for exclusively economic and health considerations. The lists of priority IAS presented in this manual also include a broad spectrum of species that are or may be a threat to the native biodiversity of the Segura river basin. At European level, as well as at the level of specific biogeographical regions, several works have recently been carried out to prepare lists of priority IAS for management with a similar but more complete development dynamic than that presented in this document (e.g. Gallardo et al. 2016, Carboneras et al 2017, Gallardo and Capdevila 2018, Roy et al., 2018).

2. LIST OF PRIORITY IAS IN THE SEGURA RIVER BASIN: RESULT OF THE IMPLEMENTATION OF THE LIFE + RIPISILVANATURA

2. LIST OF PRIORITY IAS IN THE SEGURA RIVER BASIN: RESULT OF THE IMPLEMENTATION OF THE LIFE + RIPISILVANATURA.

2.1. 2.1 Objectives and methodology used: workshops to prepare priority lists of IAS.

In the context of the design of strategic lines of management and control of IAS in the Segura river basin, the LIFE + RIPISILVANATURA project (LIFE13 BIO/ES/001407) has implemented the development of workshops for the preparation of IAS lists priorities in management (Figure 2.1) (Action A2). This process of cooperative participation among a large group of experts and technicians carried out during 2018 has had the following main objectives for the entire area of the Segura river basin:

(1) Preparation of a complete list of IAS present and established in the aquatic environment and riparian habitats.
(2) Development of the Catalog of priority IAS for management in the Segura river basin.
(3) Realization of a list of indicative relationships of invasive potential, called alert list, which should be understood as an open inventory that will be updated constantly.
(4) Participatory discussion on recommendations and guidelines for its management.

Collaterally, the workshops carried out (Figure 2.1) have contributed to the sharing of the situation of IAS in the Segura river basin. In order to prepare inventories of IAS that have an application in management, the available and current information on dozens of taxa has been collected in monographic records. Thus, the lists and monographic information sheets produced are the result of the joint effort of the group of experts and technicians who, as participants in the whorkshops or authors of these sheets, have made very useful contributions, regardless of the volume of information contributed.

Figure 2.1. Workshops held with experts and technicians to prepare lists of priority IAS in management in the context of the LIFE + RIPISILVANATURA project.

Approximately 30 participants have assumed the task of collecting information and the specific treatment of all IAS presents in the Segura river basin. As a whole, information about their knowledge, their status of invasion and tendency of their populations has been incorporated and systematized. That's constitutes a first framework for assessment and management at the river basin level. This information is basic for its evaluation and application in a strategic management context.

The inventory exercise or initial list of taxa was carried out with simple selection criteria related to biology, ecology, distribution and invasive character. Thus, under the precautionary principle in management, the initial work inventory was prepared with established species with a confirmed invasive character (IAS) in the Segura river basin, together with exotic species with uncertainty about their ecological and socioeconomic impacts. In addition, only those taxa that develop their cycle partially or totally in aquatic systems and riparian environments were considered. The exotic species that inhabit exclusively in anthropic environments have not been evaluated, nor the considered pests or diseases that affect agricultural crops, livestock, etc. The latter are included in collateral regulations for the management of biodiversity that are not the subject of the lists prepared in this work (e.g. Directive 2000/29/EC, Regulation 708/2007, etc.). Exceptionally and in a consensual manner, certain taxa have been included that are not exclusively dependent on the aquatic systems and riparian environments in their life cycle but that are common in these habitats.

To this sequence of criteria was incorporated the opinion of the experts in the groups of species on aspects related to the prioritization of concrete taxa and the specific treatment of them. Thereby, for the incorporation of the species in the list known as the Catalog of priority IAS for management in the Segura river basin, priority criteria were used, basically related to two general aspects concerning to:

(1) The effects or impacts on native biodiversity and on natural or semi-natural ecosystems.
(2) The possibilities of management, control and eradication of the species.

3. RESULTS: PRIORITY LISTS OF MANAGEMENT

3. RESULTS: PRIORITY LISTS OF MANAGEMENT.

3.1. Catalog of priority IAS for management in the Segura river basin.

A list composed of a total of 47 taxa (27 fauna and 20 flora) present and established in the aquatic environment or in riparian habitats of the basin has been inventoried, which, as a whole, make up the so-called *Catalog of priority IAS for management in the Segura river basin* (Tables 3.1 and 3.2). 46.8% of the taxa included in this list are formed of species present in the *Spanish Catalog of Invasive Alien Species* (RD 630/2013) in the scope of application of the Segura river basin, although only 8, 5% are species that are included in the *List of Invasive Alien Species of Union concern* that stem from the application of Regulation (EU) No. 1143/2014.

The process of invasion by IAS of the aquatic systems and riparian habitats of the Segura river basin has been developing for years. However, in recent decades it has accelerated and 56.5% of the IAS present and included in this Catalog of priority IAS for management have colonized the Segura river basin after 1975 (Figure 3.1). In addition, more than half of the taxa included in this catalog (approximately 57,8%) show an extended distribution in the river basin with its presence in several ecogeographic sectors and with an affection in several types of habitats (Figure 3.2). These patterns highlight the need for the establishment of measures that reduce invasion rates and allow rapid or early response in the management of new invasions, both from the river basin itself and from non-affected sectors within it. In this context, the establishment of a monitoring network and early warning to quickly locate new sites of these IAS is another basic tool that should be established in its strategic management.

Another pattern particularly significant is that 73,7% of the inventoried species come from intentional or negligent introductions. This aspect highlights the need for training and awareness campaigns in key sectors involved in processes related to the dispersal of aquatic IAS (e.g. sport fishing, aquatic sports, fishkeeping, agriculture, etc.). Likewise, within these preventive measures related to awareness raising, it is necessary to involve these sectors in surveillance and control.

Table 3.1. Catalog of priority IAS for management in the Segura river basin (fauna). The scientific name, common name, as well as its inclusion in the R.D. 630/2013 in the scope of application of the Segura river basin and in the List of invasive alien species of Union concern (P: present).

Scientific name	Common name	R.D. 630/2013	EU List
NON-ARTHROPOD INVERTEBRATES (Except mollusc)			
Anguillicoloides crassus	Parasitic nematode of eels	--	--
MOLLUCS			
Corbicula fluminea	Golden freshwater clam	P	--
Gyraulus chinensis	--	--	--
Physa acuta	--	--	--
Potamopyrgus antipodarum	New Zealand Mudsnail	P	--
CRUSTACEANS			
Callinectes sapidus	Blue crab	--	--
Lernaea cyprinacea	Anchor worm	--	--
Pacifastacus leniusculus	Signal crayfish	P	P
Procambarus clarkii	Red swamp crayfish	P	P
NON-CRUSTACEAN ARTHROPODS			
Aedes albopictus	Asian tiger mosquito, Forest day mosquito	P	--
Rhynchophorus ferrugineus	Red palm weevil	P	--
FISHES			
Alburnus alburnus	Bleak	P	--
Carassius auratus	Goldfish	--	--
Cobitis paludica	Iberian loach	--	--
Cyprinus carpio	Common carp	P	--
Esox lucius	Northern pike	P	--
Gambusia holbrooki	Eastern mosquitofish	P	--
Gobio lozanoi	Iberian gudgeon	--	--
Lepomis gibbosus	Pumpkinseed	P	--
Micropterus salmoides	Largemouth black bass	P	--
Pseudochondrostoma polylepis	Iberian nase	--	--
Oncorhynchus mykiss	Rainbow trout	P	--
Sander lucioperca	Pike-perch	P	--
REPTILES			
Trachemys spp.	Yellow-bellied Slider Turtle	P	P
BIRDS			
Cairina moschata	Muscovy Duck	--	--
Estrilda spp.	Waxbill	P	--
Tadorna ferruginea	Ruddy Shelduck	--	--

Table 3.2. Catalog of priority IAS for management in the Segura river basin (flora). The scientific name, common name, as well as its inclusion in the R.D. 630/2013 in the scope of application of the Segura river basin and in the List of invasive alien species of Union concern (P: present); *: present in another scope of application; **: presence of the species *Pennisetum setaceum*).

Scientific name	Common name	R.D. 630/2013	EU List
	FLORA		
Acacia sp.pl.	Wattle, acacia	*	--
Acacia farnesiana	Cassie flower, fragrant acacia, sweet acacia	*	--
Ailanthus altissima	Tree of heaven	P	--
Araujia sericifera	Bladder flower, moth vine	P	--
Arundo donax	Giant reed	*	--
Austrocylindropuntia sp. pl.	Cholla	P	--
Cercis siliquastrum	Judas tree	--	--
Cortaderia sp.pl.	Pampas grass	P	--
Elaeagnus angustifolia	Russian olive	--	--
Eucalyptus sp. pl.	Eucalypts	--	--
Ipomoea sp. pl.	Morning glory	*	--
Lantana camara	Lantana	--	--
Lonicera japonica	Japanese honeysuckle	--	--
Nicotiana glauca	Tree tobacco	--	--
Oxalis pes-caprae	Bermuda buttercup	P	--
Pennisetum sp.pl.	Grass	**	**
Platanus hispanica	Plane	--	--
Populus x canadensis	Canadian poplar	--	--
Robinia pseudoacacia	Black locust, false acacia	--	--
Zygophyllum fabago	Syrian beancaper	--	--

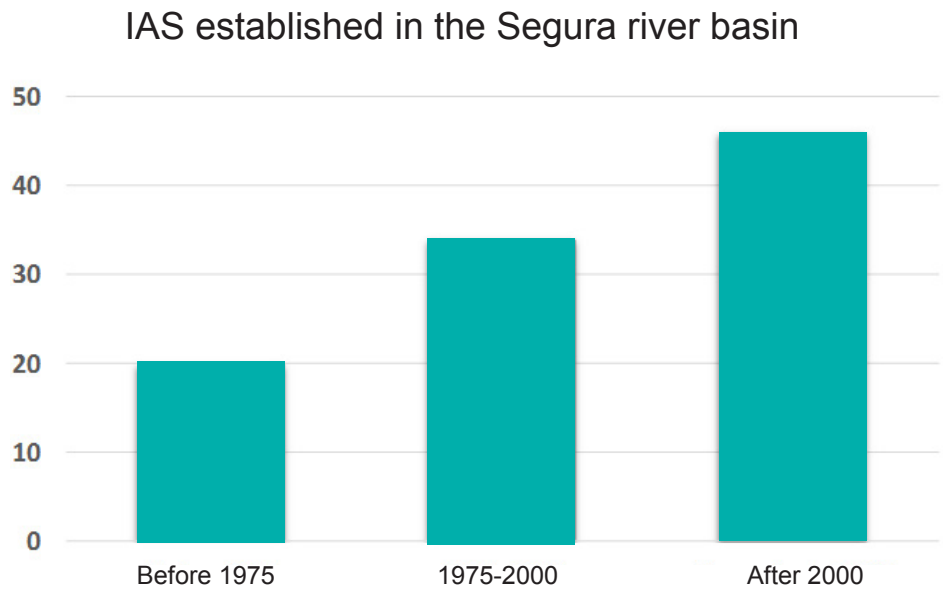

Figure 3.1. Temporal evolution in taxa present in the Segura river basin included in the *Catalog of priority IAS for management in the Segura river basin*. It is presented the total number of taxa established based on three time periods.

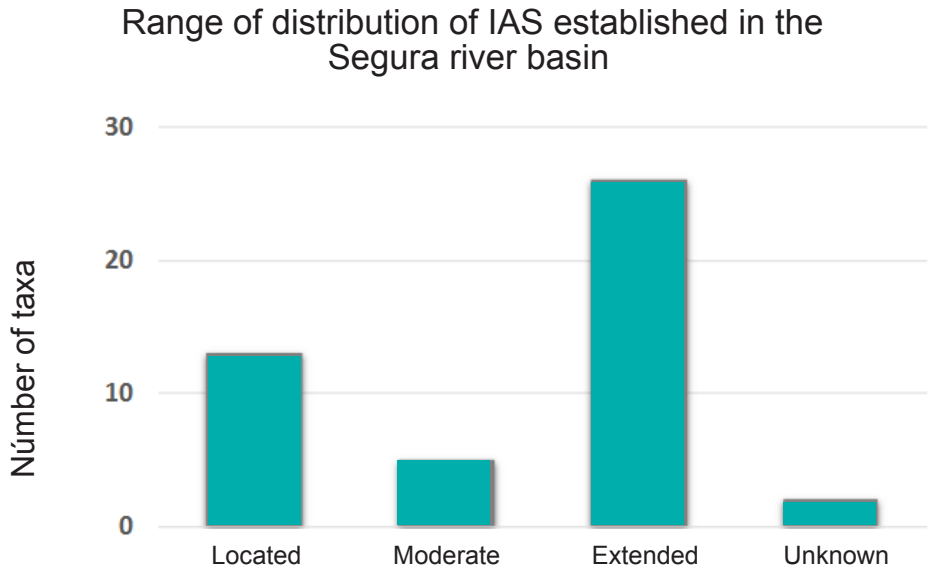

Figure 3.2. Current distribution of taxa present in the Segura river basin included in the *Catalog of priority IAS for management in the Segura river basin*. It is presented the total number of taxa according to the range of distribution categories established in this document.

3.2. Alert list of IAS with invasive potential in the Segura river basin.

In the context of a preventive management strategy, a first inventory of species with invasive potential has also been established, forming an alert list of 115 taxa (75 fauna, 40 flora) (Tables 3.3, 3.4 and 3.5). 42.6% of these taxa are included in the R.D. 630/2013 that includes the Spanish catalog of invasive alien species but only 10.4% are presents in the List of invasive alien species of Union concern.

This IAS Alert List for the Segura river basin should be understood as an open inventory with the need for periodic updating. It should be a tool that facilitates decision-making in sectors that are competent in preventive management, that indicates priorities for monitoring and that can constitute a reference list for all the sectors involved.

It should be designe mechanisms that allow a periodic review of these lists for its updating. It is necessary to understand that lists are flexible instruments and that risk analysis procedures are essential and mandatory elements for making decisions about potential introductions, whether primary in the river basin or secondary over non-invaded areas.

Table 3.3. Alert list of IAS whith invasive potential in the Segura river basin (invertebrate fauna). Its is presented scientific name, common name, as well as its inclusion in the R.D. 630/2013 and in the LIST of invasive alien species of Union concern (P: present; *: cited taxa not established).

Scientific name	Common name	R.D.630/2013	UE List
NON-ARTHROPOD INVERTEBRATES (Except molluscs)			
Branchiura sowerbyi	Oligochaete, A tubificid worm	--	--
Cordylophora caspia	Freshwater hydroid	P	--
Craspedacusta sowerbyi	Freshwater jellyfish	--	--
Dactylogyrus anchoratus	Carassitus auratus parasite	--	--
Ficopomatus enigmaticus	Australian tubeworm	P	--
Gyrodactylus cyprini	*Cyprinus carpio* parasite	--	--
Gyrodactylus katharineri	*Cyprinus carpio* parasite	--	--
Phyllodistomum folium	*Dreissena polymorpha* parasite	--	--
Pseudodatylogyrus anguillae	*Anguilla anguilla* parasite	--	--
Xirongiton victoriensis	*Pacifastacus leniusculus* parasite	--	--
MOLLUSCS			
Dreissena bugensis	Quagga mussel	P	--
Dreissena polymorpha	Zebra mussel	P	--
*Ferrissia fragilis**	Fragile Ancylid	--	--
Limnoperna securis	Mussel	P	--
Melanoides tuberculatus	Kangaroo snail, red-rimmed melania	P	--
Mytilopsis leucophaeta	Dark false mussel	P	--
*Planorbella duryi**	Seminole Rams Horn	--	--
Pomacea maculata	Island apple snail	P	
Sinanodonta woodiana	Chinese pond mussel	P	--
CRUSTACEANS			
Argulus japonicus	Japanese fishlous	--	--
Artemia franciscana	San Francisco brine shrimp	--	--
Cypris spp.	Cypris	--	--
Cherax destructor	Common yabby crayfish	P	--
Dikerogammarus villosus	Killer shrimp	P	--
Eriocheir sinensis	Chines mitten crab	P	P
Ilyodromus viridulus	----	--	--
Oronectes limosus	Spinycheek crayfish	P	P
Palaemon macrodactylus	Oriental shrimp	--	--
Procambarus virginalis	Marbled crayfish	--	--
Rhithropanopeus harrisii	Dwarf crab; estuarine mud crab	P	--
Triops longicaudatus	Summer tadpole shrimp	P	--
Stenocypris major	----	--	--
NON-CRUSTACEAN ARTHROPODS			
Anoplophora chinensis	Citrus longhorn beetle	--	--
Apate monachus	Black borer	--	--
Eidmannella pallida	----	--	--
Heteropoda venatoria	Huntsman Spider	--	--
Macrothele calpeiana	Funnel web spider	--	--
Pholcus opilionoides	Daddy-long-legs spider	--	--
Pholcus phalangioides	Long-bodied cellar spider	--	--
Stenopelmus rufinasus	Water fern weevil	--	--
Trichocorixa verticalis	---	--	--
Vespa velutina	Asian hornet	P	P

Table 3.4. Alert list of IAS whith invasive potential in the Segura river basin (vertebrate fauna). Its is presented scientific name, common name, as well as its inclusion in the R.D. 630/2013 and in the List of invasive alien species of Union concern (P: present; *: cited taxa not established).

Scientific name	Common name	R.D.630/2013	UE List
FISHES			
Ameiurus melas	Black bullhead	--	--
*Australoheros facetus**	Chameleon cichlid, Chanchito	P	--
Blicca bjoerkna	Silver bream	--	--
Carassius carassius	Crucian carp	--	--
Carassius gibelio	Prussian carp	--	--
Coptodon zillii	Redbelly tilapia	--	--
Ctenopharyngodon idella	Grass carp	--	--
Fundulus heteroclitus	Mummichog	P	--
Gambusia affinis	Mosquito fish	--	--
Ictalurus punctatus	Channel catfish	P	--
Misgurnus anguillicaudatus	Oriental weatherfish	P	--
Oreochromis spp.	Tilapia	--	--
Perca fluviatilis	Perch	P	--
Pseudorasbora parva	Topmouth gudgeon	P	P
Poecilia reticulata	Guppy	--	--
Rhodeus amarus	Bitterling	--	--
Rutilus rutilus	Roach	P	--
Scardinius erythrophthalmus	Rudd	P	--
Silurus glanis	Wels catfish	P	--
*Tinca tinca**	Tench	--	--
AMPHIBIANS			
Lithobates catesbeainus	American Bullfrog	P	P
REPTILES			
Chinemys (=Mauremys) reevesii	Chinese pond turtle, Chinese three-keeled pond turtle, Reeves turtle	--	--
Chrysemys picta	Painted turtle	P	--
Graptemys pseudogeographica	False map turtle	--	--
*Pseudemys spp.**	Cooter	*P. peninsularis*	--
BIRDS			
Alopochen aegyptiacus	Egyptian Geese	P	--
Amandaba amandaba	Red avadavat	P	--
Euplectes afer	Yellow-crowned Bishop	P	--
Haemorhous mexicanus	House finch	--	--
*Myiopsitta monachus**	Monk Parakeet	P	--
Oxyura jamaicensis	Ruddy duck	P	P
Ploceus cucullatus	Village weaver	P	--
MAMMALS			
Neovison vison	American mink	P	P
Ondata zibethicus	Muskrat	P	P

Table 3.5. Alert list of IAS whith invasive potential in the Segura river basin (flora). Its is presented scientific name, common name, as well as its inclusion in the R.D. 630/2013 and in the List of invasive alien species of Union concern (P: present; *: except *Hydrocotyle vulgaris*;**: except *Ludwigia palustris*).

Scientific name	Common name	R.D.630/2013	UE List
	FLORA		
Didymosphenia geminata	Didymo, rock snot	P	
Acacia dealbata	--	P	--
Agave sp. pl.	Agave	*A. americana*	--
Aloe vera	--	--	--
Aptenia cordifolia	Baby sun rose	--	--
Artemisia verlotiorum	--	--	--
Atriplex semibaccata	Creeping saltbush	--	--
Azolla sp. pl.	Water fern	P	--
Bidens sp. pl.	Beggarticks	--	--
Cabomba caroliniana	Carolina fanwort	P	P
Carpobrotus sp. pl.	Ice plant	*C. acinaciformis,* *C. edulis*	-- --
Conyza sp. pl.	Fleabane	--	--
Cyperus alternifolius	Umbrella plant	--	--
Datura sp. pl.	Jimsonweed	--	--
Egeria densa	Brazilian elodea	P	--
Eichhornia crassipes	Water hyacinth	P	P
Fallopia convolvulus	Black bindweed	--	--
Gleditsia triacanthos	Honey locust	--	--
Helianthus tuberosus	Jerusalem artichoke	--	--
Heliotropium curassavicum	--	--	--
Hydrilla verticillata	Hydrilla	--	--
*Hydrocotyle sp. pl. **	Pennywort	*H. ranunculoides*	--
Lemna minuta	Least Duckweed	--	--
*Ludwigia sp. pl. **	--	P	*L. grandiflora* *L. peploides*
Malephora crocea	Red ice plant		
Melia azedarach	Chinaberry	--	--
Myriophyllum aquaticum	Parrot feather	--	--
Nymphaea mexicana	Yellow water-lily, mexican water-lily	P	P
Opuntia sp. pl.	Cactus pear	P	--
Parkinsonia aculeata	Mexican palo-verde	*O. dillenii,* *O. maxima,* *O. stricta*	-- -- --
Paspalum paspalodes	Knotgrass	--	--
Periploca graeca	--	--	--
Pistia stratiotes	Water lettuce	--	--
Pyracantha sp. pl.	Firethorn	P	--
Ricinus commnunis	Castor bean	--	--
Salvinia sp. pl.	Salvinia	--	--
Senecio angulatus	Creeping groundsel	P	--
Stenotaphrum secundatum	Buffalo grass	--	--
Washingtonia sp. pl.	Palms	--	--
Xanthium sp. pl.	Cockleburs	--	--
Yucca sp. pl.	Yucca	--	--

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