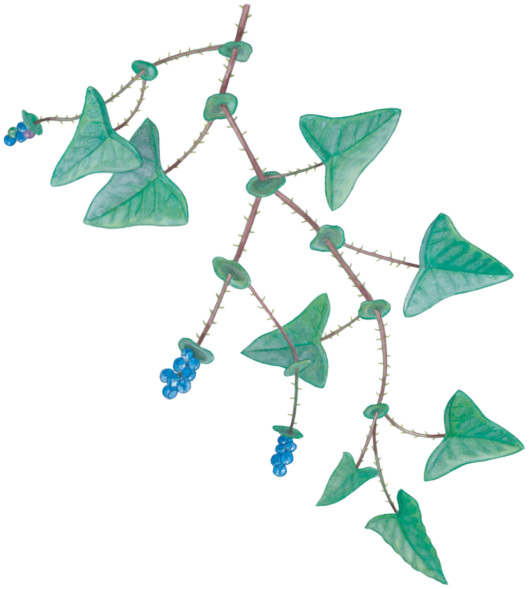
European Commission

# An Introduction to the

# EU Regulation on Invasive Alien Species



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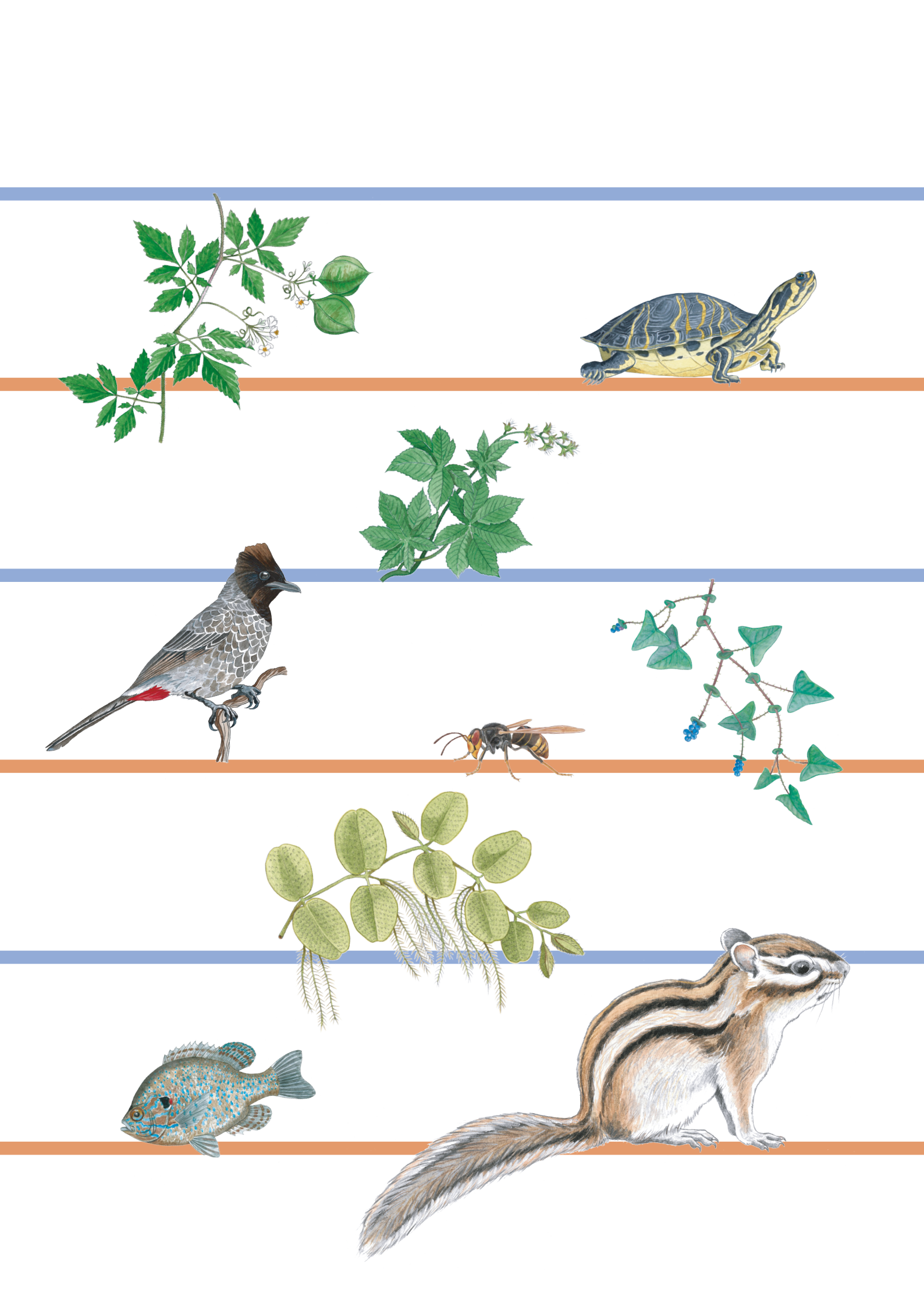

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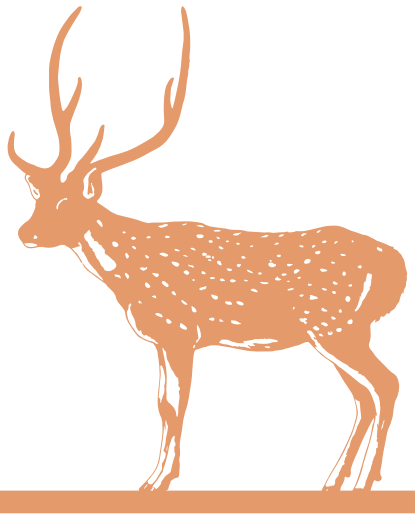

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**Authors:** Costello, K.E., Scalera R., Nunes, A.L. and Smith, K.

**Design and Layout:** Sabina Salussolia

**Illustrations:** Massimiliano Lipperi, Studio Wildart. Reuse is authorised provided the source is acknowledged.

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# Contents

# What

## are Invasive Alien Species ?

Alien species are organisms which are introduced to regions in which they would not be found naturally, as a result of unintentional or deliberate human action. Examples include parakeets moved for the pet trade from one continent to another, then released in the wild, or hornets travelling as hitchhikers with goods transported across the oceans.

In the majority of cases, alien species are unable to survive in their new environment without human support (e.g. food and shelter). However, a small proportion will manage to adapt to their new surroundings and establish populations in the wild. Some of these alien species have negative impacts on the environment, for example predation or competition for resources with native animals or plants: these are called **Invasive Alien Species (IAS)**. They may also alter ecosystem services such as water supply, impact national economies and agricultural production, or harm human health.

Red swamp crayfish (*Procambarus clarkii*) control, GREENing the BLUE canals infrastructure of Reno basin to enhance ecosystem connectivity and services, LIFE GREEN4BLUE (LIFE NAT/IT/000946) 

## Alien species in the EU

Key information on alien species in Europe can be found in the European Alien Species Information Network (EASIN) portal (see Key Resources), launched in 2012 by the Joint Research Centre of the European Commission. The EASIN platform consolidates existing alien species data, and is designed to facilitate the implementation of *Regulation (EU) 1143/2014 on Invasive Alien Species*.

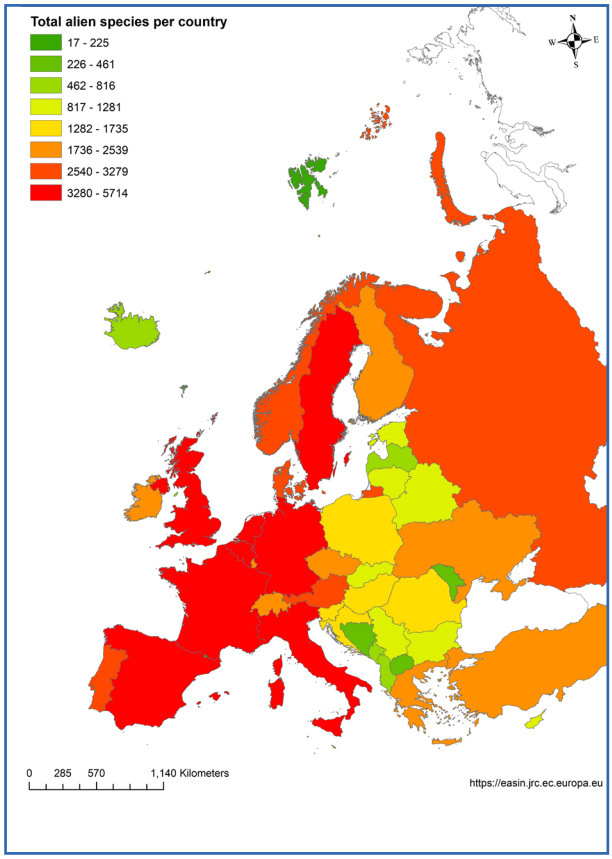
According to EASIN there are currently over 14,000 alien species introductions recorded in Europe. They belong to all taxonomic groups, ranging from mammals, reptiles, amphibians, fish and invertebrates to plants, algae, fungi, bacteria and other microorganisms. Alien species can be found in terrestrial, freshwater, brackish and marine environments, and are known from every EU Member State.

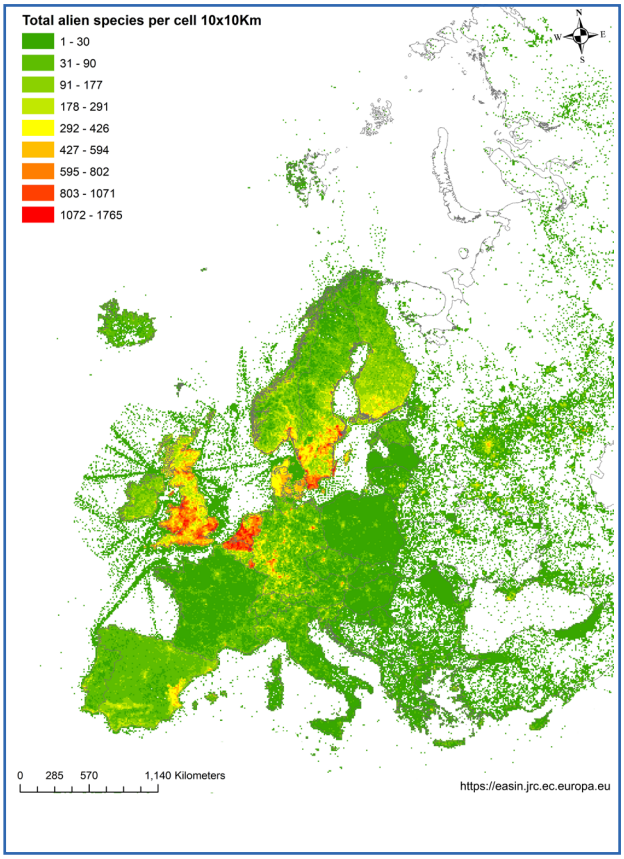
Terrestrial plants are by far the most common alien species, representing nearly half of all species present in Europe (6,368 species), followed by terrestrial animals (4,682 species). Marine alien species are also relatively abundant, with 1,264 animals present. Freshwater animals on the other hand are less numerous, with only 641 species recorded in Europe.

Golden wreath wattle (*Acacia saligna*)

# Distribution

## of alien species in Europe




Data from EASIN (Joint Research Centre, 2022)

# Examples

## of Invasive Alien Species in Europe

*Acridotheres tristis* © Bird Explorers, (CC BY-NC) via iNaturalist

The **common myna** (*Acridotheres tristis*) is a small, social bird native to Asia. It has been recorded in many EU Member States, with established populations currently confirmed in Portugal and Italy. Their introduction is primarily due to intentional releases from the pet trade, and escapes from captivity (e.g. zoos). There is growing concern about the species' spread in Europe due to the multitude of impacts documented in other invaded regions, including the decline of native bird populations.

The **New Zealand flatworm** (*Arthurdendyus triangulatus*) is established in one EU Member State (Ireland) as of 2022. It is likely that the species was introduced via the ornamental and horticultural trade, in soil and plant materials. This nocturnal flatworm is an aggressive predator of native earthworms, declines of which would reduce both nutrient-cycling and food sources for native animals.

*Arthurdendyus triangulatus* © callumcregan, (CC BY-NC) via iNaturalist

*Cortaderia jubata* © melanie99, (CC BY-NC) via iNaturalist

**Purple pampas grass** (*Cortaderia jubata*) is a tall, perennial plant native to South America. It is not currently established in the wild within the EU, but has the potential to impact vast areas if it does. In other invaded ranges (including New Zealand and California) it can form dense grasslands, outcompeting native flora. Each plume can produce over 100,000 seeds and the sheer volume of dry material produced by this species poses a significant fire hazard.

*Procyon lotor* © David Slater, (CC BY 2.0) via Flickr

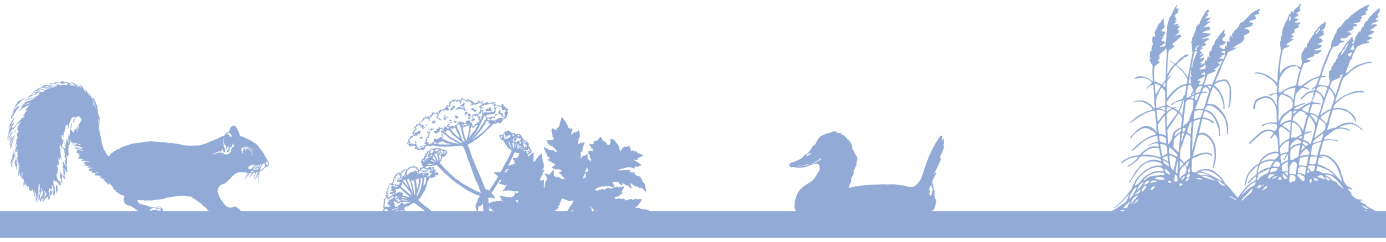
The **raccoon** (*Procyon lotor*) is a carnivore with generalist feeding habits, native to North America. The species is widely established in the EU due to releases and escapes as a consequence of being kept as a pet, in addition to historical escapes from fur farms. Raccoons are known to impact native amphibians and reptiles, but particularly ground nesting birds. They are also known to carry diseases of concern for human and livestock health, including rabies and roundworm.

The **red imported fire ant** (*Solenopsis invicta*), sometimes known as the RIFA, is native to South America. This ant is known for having a very painful sting, which may cause allergic reactions in some people. This species has been recorded in the Netherlands but is not currently established in any EU Member State, as this is dependent on the introduction of queen ants. The impact of this species on biodiversity is known to be severe based on the experience in other invaded regions, threatening multiple vertebrate and invertebrate taxa through competition, stinging and predation.

*Solenopsis invicta* © Judy Gallagher, (CC BY 2.0) via Flickr

*Xenopus laevis* © Marius Burger, (CC0 1.0) via iNaturalist

The **African clawed frog** (*Xenopus laevis*) has established in several EU Member States due to deliberate releases coupled with escape from the pet trade and research laboratories. The tadpoles are primarily planktivorous, while adults predate upon aquatic invertebrates, native amphibians and fish, the latter meaning the frog may be considered a threat to freshwater aquaculture farms.



# How

## do invasive alien species get into the EU ?

The movement of people and goods around the world has increased hugely over the past decades. This has provided opportunities for the introduction of species outside their natural range. The different ways in which species are transported from one place to another are called 'pathways'. Common pathways include the release of fish for fisheries into the wild, escape from farms and horticulture, releasing pets in nature, passive transport within ship ballast water and spread through artificial corridors such as canals. These pathways, which can be intentional or unintentional, enable invasive alien species to cross the biogeographic barriers that otherwise would block their dispersal.

The Convention on Biological Diversity (CBD) has categorised pathways into six main groups:

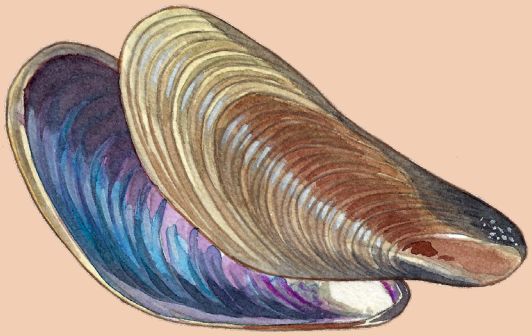
- Release in nature
- Escape from confinement
- Transport – contaminant
- Transport – stowaway
- Corridors
- Unaided

Each of these pathway categories are further sub-divided; for example, 'Escape from confinement' encompasses escape from aquaculture, pet/aquaria/terraria escapes, fur farms, horticulture, ornamental purposes, live food and live bait (among others). It is important to note that once introduced into a country, IAS may spread naturally, or through 'secondary pathways', which may differ from the primary ones. For example, an aquatic plant may be released into the wild via the aquarium trade, but then spread via hitchhiking on boats and angling equipment.

IAS are often associated with one or more pathways of introduction. For example, alien plant species, terrestrial and aquatic, often escape from the ornamental and horticultural trades. Freshwater animals are often intentionally introduced for aquaculture or recreational angling, whereas in the marine environment many IAS enter Europe via unintentional transport, as stowaways in ballast water or as hull fouling organisms. Understanding which pathways are responsible for introducing IAS is critical if measures are to be taken to prevent future introductions.

## The rise of 'new' invasive alien species

The number of species being introduced to new regions for the first time is increasing. This can pose significant challenges to biosecurity, as the number of species that need to be addressed is constantly on the rise. One recent study[1] found that in the past 200 years, 37% of records of a species being introduced to a new region for the first time occurred since 1970.



Golden mussel (*Limnoperna fortunei*)

[1]Seebens *et al.* (2017) No saturation in the accumulation of alien species worldwide. *Nature Comms.* 8 , 14435. doi: 10.1038/ncomms14435

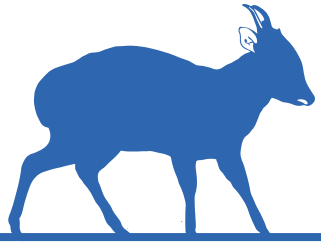
# Examples

## of pathways and associated species

*Pontederia crassipes* © vinicius_s_domingues, (CC BY-NC) via iNaturalist

**Ornamental plant trade** - The water hyacinth (*Pontederia crassipes*) is a freshwater invader which is popular in the ornamental trade due to its distinctive blue/violet flowers. Under suitable conditions water hyacinth reproduces rapidly, and can double its biomass in 6 – 14 days. This results in dense mats of the plant, which can overgrow aquatic habitats.

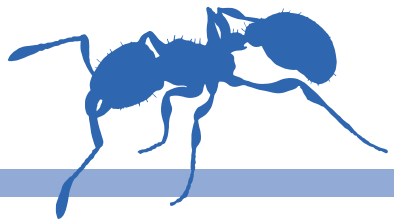
**Hunting** - Muntjac deer (*Muntiacus reevesi*) have been deliberately and unintentionally introduced across Europe, historically to provide ornamentation in country estates, but in more recent times to create or supplement local populations of game species for hunting.



*Muntiacus reevesi* © Alex Roddie, (CC BY-NC) via iNaturalist

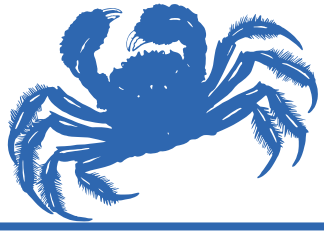
*Wasmannia auropunctata* © Philipp Hoenle, (CC BY-NC) via iNaturalist

**Contaminant** - The little fire ant (*Wasmannia auropunctata*) is invasive in Africa, North and South America, Australia and Europe, due in no small part to its ability to exploit multiple pathways. These include contamination of soil, plants or food, which are transported around the world, or indeed unaided spread via floating debris.



*Eriocheir sinensis* © iStockphoto/MikeLane45

**Shipping trade** - The main pathway for the Chinese mitten crab (*Eriocheir sinensis*) arises from the global shipping industry, specifically when planktonic stages of the species are unintentionally transported in ship's ballast water. Corridors and natural dispersal are then available to facilitate further spread, as the crab can disperse through interconnected waterways.



**Biological control** - The introduction of the eastern and western mosquito fish, *Gambusia holbrooki* and *Gambusia affinis*, is an example of species intentionally released for biological control. Mosquitofish were introduced throughout Europe and around the world to control mosquito populations and reduce transmission risk for diseases such as malaria. However, there is little evidence that the fish have been effective in this; though they have become a threat to native freshwater fauna.

*Gambusia affinis* © leemarlowe, (CC BY-NC) via iNaturalist

*Fundulus heteroclitus* © Alex R., (CC BY-NC) via iNaturalist

**Pathway combinations** - Many IAS utilise multiple pathways, for example the mummichog (*Fundulus heteroclitus*), a small killifish that inhabits freshwater and brackish environments. Mummichog can be introduced through multiple pathways including transport as a contaminant on bait or in aquaculture consignments. Additionally, they may escape from laboratories (escape from confinement) or be transported in ballast water.

# Addressing

## unintentional introductions

Preventing the unintentional introduction of IAS can be challenging. Member States must first identify those pathways that are a priority based on the volume of past and potential future introductions of IAS associated with them. Then measures need to be taken to reduce the risk of their introduction.

Addressing pathways of unintentional introduction requires strong biosecurity practices across multiple sectors. These include the implementation of inspections, disinfection protocols and appropriate facilities and training for all personnel involved. It is also essential to raise awareness through communication campaigns, to ensure citizens are informed of the best practices to minimise potential spread.

A number of sectors have already adopted codes of practice and guidelines to address the risk of accidental IAS introductions, for example the European Codes of Conduct for:

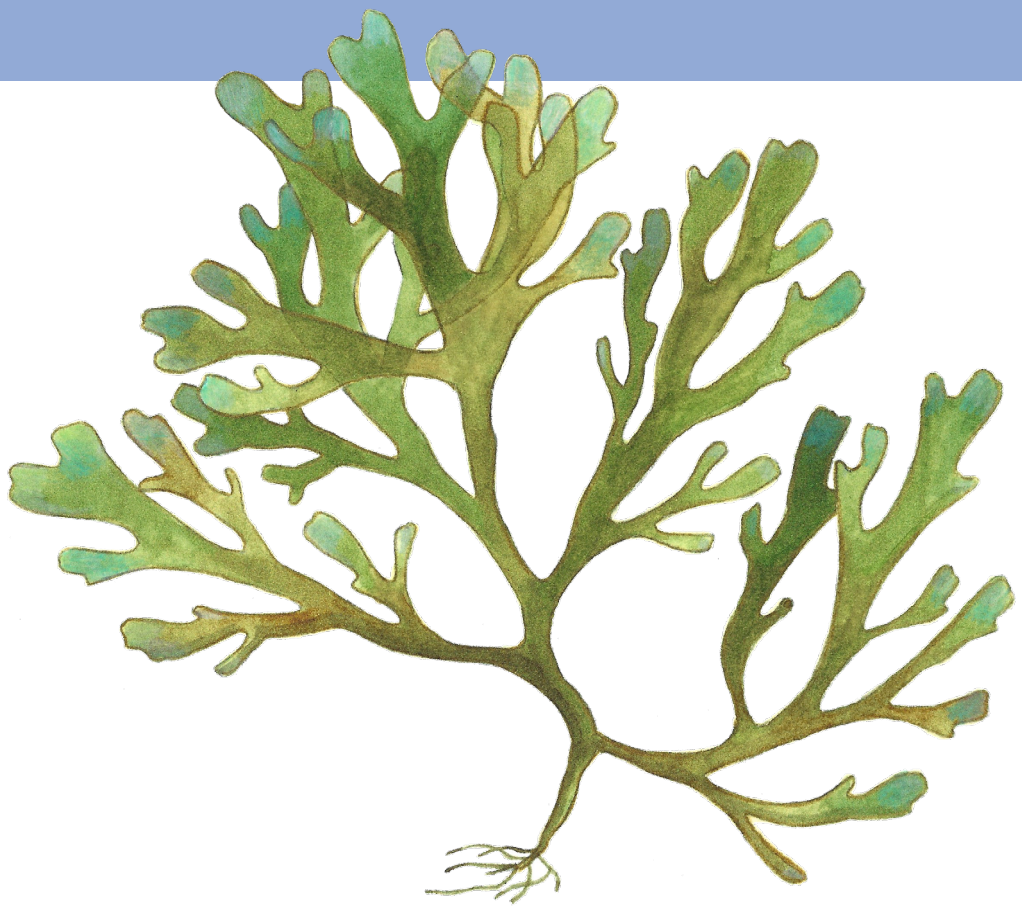
- Recreational Boating and IAS
- Fishing and IAS
- Hunting and IAS
- Zoological Gardens and Aquaria on IAS
- Botanic Gardens on IAS
- Pets and IAS
- Horticulture and Invasive Alien Plants
- International Travel and IAS
- Invasive Alien Trees

In addition, the ICES Code of Practice on the Introductions and Transfers of Marine Organisms (2005) provides guidance for biosecure aquaculture practices. A large number of phytosanitary measures, for example those recommended by the European and Mediterranean Plant Protection Organization (EPPO) and International Plant Protection Convention (IPPC), can further limit the risk of introducing IAS if correctly applied.

Cargo vessel © julochka, (CC BY-NC 2.0) via Flickr

## Tackling marine invasive alien species

In the marine environment, the two primary vectors by which IAS are transported currently are ships' ballast water and hull fouling. On occasions where IAS disperse unaided through canal networks, shipping traffic can also facilitate their secondary spread. To counter this, the International Convention for the Control and Management of Ships' Ballast Water and Sediments (entered into force 2017) seeks to restrict introductions arising from the oceanic shipping network. This is done by enforcing ballast water exchange (BWE) under specified conditions, and moving to have the global fleet fitted with Ballast Water Management (BWM) systems. The International Maritime Organisation (IMO) also facilitates the development and application of guidelines on the fouling of ship hulls.

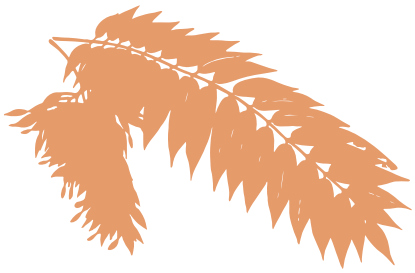


Okamura's brown alga (*Rugulopteryx okamurae*)

# Why

## are invasive alien species such a problem ?

Invasive alien species are considered one of the primary threats to biodiversity and ecosystems, particularly when acting in synergy with other drivers of biodiversity loss. Furthermore, IAS can lead to severe economic and human health impacts in areas where they occur. IAS impact native species in Europe via a number of mechanisms, which are listed below according to the IUCN Environmental Impact Classification for Alien Taxa (EICAT) Standard. IAS can also facilitate the establishment of further IAS, potentially intensifying each other's impacts.



**The different ways in which alien species impact biodiversity according to the IUCN EICAT Standard**

1. Competition
2. Predation
3. Hybridisation
4. Transmission of disease
5. Parasitism
6. Poisoning/toxicity
7. Bio-fouling or other direct physical disturbance
8. Grazing/herbivory/browsing
9. Chemical impact on ecosystem
10. Physical impact on ecosystem
11. Structural impact on ecosystem
12. Indirect impacts through interactions with other species

## IUCN Environmental Impact Classification for Alien Taxa (EICAT)

EICAT is the IUCN global standard for measuring the magnitude of environmental impacts caused by invasive alien species (see Key Resources). The tool is designed to inform scientists, conservation practitioners and policy makers about the potential consequences of these species. It also guides the development of prevention and mitigation measures, and assists in prioritising management actions.

The impact of IAS can at times be so profound that they alter the functioning of entire ecosystems, compromising their ability to provide irreplaceable ecosystem services including erosion and flood control, pollination and carbon storage. IAS may also hinder economic processes by interfering with industries such as aquaculture, forestry and crop production. They can severely impact human health, by acting as hosts or vectors of pathogens and disease or having venoms, poison and toxins to which humans are susceptible.

Restoring the Baltic coastal habitat networks, CoastNet LIFE (LIFE17 NAT/FI/000544)


## Invasive alien species in protected areas

Managing IAS will facilitate the preservation of protected areas, for example the EU Natura 2000 network. Covering over 18% of the EU's land area and more than 8% of its marine territory, Natura 2000 is the largest coordinated network of protected areas in the world.

Preventing the incursion of IAS into protected areas includes screening and addressing pathways and/or vectors and acting on evidence-based risk assessments. Citizen science could significantly improve the efficacy of IAS surveillance and monitoring.

NATURA 2000

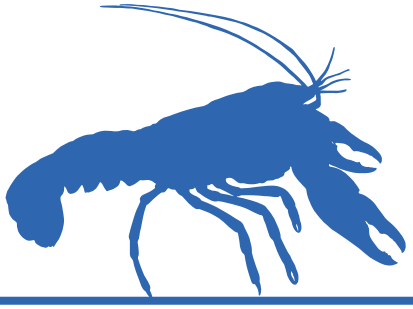
# Examples

## of invasive alien species impacts

## Ecological impacts

*Pacifastacus leniusculus* © Astacoides, (CC BY-SA 3.0) via Wikimedia Commons

The **American signal crayfish** (*Pacifastacus leniusculus*) was first released throughout Europe in the 1960's for commercial stocking in the wild. It was subsequently introduced in the wild, legally and illegally, to supplement native crayfish populations. However, the signal crayfish is an aggressive competitor, capable of out-competing the native European crayfish (*Astacus astacus*). It is also a vector for crayfish plague, a disease caused by the water mould *Aphanomyces astaci*, which causes high mortality in native crayfish species such as those from the genus *Austropotamobius*. Signal crayfish are now present in nearly all Member States, in fact the species is the most widespread invasive crayfish in Europe.



The **chital** (*Axis axis*) is a spotted deer native to southern Asia. It was introduced to Europe for hunting purposes from the 18th Century onwards, but wild populations have so far only established in Croatia. Chital are prolific grazers/browsers and may therefore impact native forest systems, in addition to consuming the vegetation that sustains native species and domesticated cattle. Chital are also known to negatively impact crop production, vineyards, gardens and orchards. If herd sizes grow too large, the deer may also increase soil erosion.

*Axis axis* © Cheryl Rosenfeld, (CC BY-NC) via iNaturalist

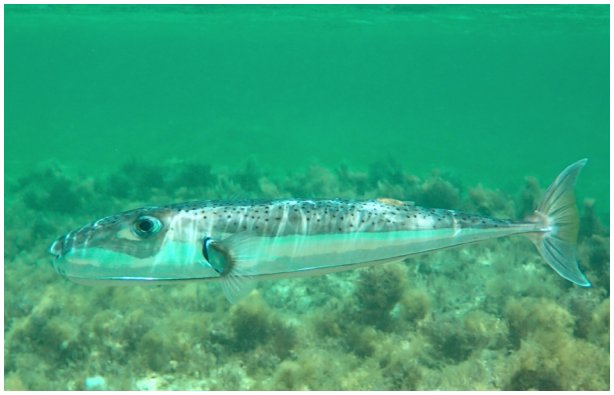
The **tree of heaven** (*Ailanthus altissima*) is native to north and central China, but is now widespread throughout Europe. This is primarily due to escape from the ornamental plant trade, coupled with natural, wind-driven seed dispersal and vegetative spread. Tree of heaven is an allelopathic plant, meaning it produces biochemicals in the form of toxins contained within the leaves and bark. These toxins then accumulate in the soil, restricting the growth of other plants and allowing *A. altissima* to outcompete native species. Additionally, the plant is capable of withstanding severe damage due to its capacity for rapid regrowth from root systems post-disturbance. These root systems also inflict damage on historic monuments and heritage sites.

Tree of heaven (*Ailanthus altissima*) LIFE DUNIAS (LIFE20 NAT-BE001442, DUNe restoration by tackling Invasive Alien Species) © 2022 Reinhardt Strubbe. All rights reserved. Licenced to the European Union under conditions.

Tree of heaven (*Ailanthus altissima*) control. A downward cut is made in the bark and a flat piece of sponge inserted prior to herbicide application. The sponge will soon be soaked with the herbicide and its use keeps the tissues wet and avoids herbicide drips/evaporation, LIFE Alta Murgia (LIFE12 BIO/IT/000213) © 2022 Francesca Casella. All rights reserved. Licenced to the European Union under conditions.

Tree of Heaven (*Ailanthus altissima*)

# Impacts on human health



*Lagocephalus sceleratus* © whennaturepauls, (CC BY-NC) via iNaturalist

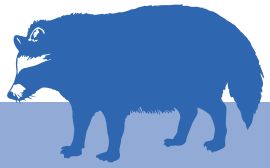
The **silver-cheeked toadfish** (*Lagocephalus sceleratus*) is a pufferfish native to the tropical Indian and Pacific Oceans. However, this IAS has entered the Mediterranean Sea through the Suez Canal, a process known as Lessepsian migration, with the first records dating back to 2003. The toadfish contains the potent neurotoxin tetrodotoxin (TTX) in its tissues, primarily in the reproductive organs but also the liver, intestine, eyes, skin and muscles. TTX can be fatal to humans if consumed, and indeed there are multiple records of fatalities arising from toadfish consumption in the invaded range. There are also records of water-users being bitten, as these toadfish have strong, fused teeth. Additionally, the species can impact small-scale fisheries by damaging nets/longlines and depredating the captured fish.

Giant **hogweed** (*Heracleum mantegazzianum*) was first brought to the EU from Russia and Georgia as an ornamental plant. Today it is widespread throughout multiple Member States, particularly along riparian habitats. It can cause severe burns and dermatitis when the sap comes in contact with skin that is exposed to sunlight. Furthermore, it may even cause blindness when in contact with eyes. The hogweed forms dense, impenetrable stands, meaning it also has a major impact on biodiversity and can alter the composition and reduce the diversity of native plant species by up to 90%.

*Heracleum mantegazzianum* © u45d, (CC BY-NC) via iNaturalist

*Nyctereutes procyonoides* © Tambako The Jaguar, (CC BY-ND 2.0) via Flickr

The **raccoon dog** (*Nyctereutes procyonoides*) is a medium-sized omnivore, widespread throughout the EU due to historical escapes from fur farms in both Member States and Russia. The species is a vector for multiple parasites which can impact both human and livestock health. In particular, raccoon dogs are known hosts for rabies, meaning that despite large-scale vaccination programmes the disease may persist in this reservoir species. This means that although they are not necessarily direct vectors, raccoon dogs can still play a significant role in the re-emergence of rabies in formerly rabies-free regions, with their high dispersal capabilities further influencing the spread of the pathogen. Additionally, raccoon dogs may carry sarcoptic mange and roundworms, parasites that can affect both humans and animals.



# The cost

## of invasive alien species to society

Once IAS are introduced to a natural environment, be it unintentionally or intentionally, significant resources are often required to alleviate the damage they cause and implement the measures required for their eradication or control.

It is estimated that the total cost of IAS in Europe (in terms of damages and management) summed to **€116.61 billion between 1960 – 2020**[2]. However, this estimate is likely to be highly conservative, as it can be extremely difficult to quantify indirect costs, for example many IAS have impacts which may indirectly affect ecosystems or human well-being. Additionally, the salary costs for IAS researchers and/or managers are not always readily available.

The costs related to IAS management increase significantly if the species is not eradicated immediately. Without early intervention, IAS will have an opportunity to disperse in the wild, build higher population densities and cause even more damage across multiple sectors. The sooner the IAS is eradicated the better the outcome for all concerned, in terms of impacts, costs and resources needed. The costs associated with IAS damage and management are generally born by a wide collaboration of people, including public authorities, land owners and farmers, researchers, and civil society.

It is occasionally noted that some IAS generate economic benefits, in addition to their negative impacts, which is often why they were initially introduced. However, it is essential to remember that these perceived benefits to specific sectors will generally be outweighed by the overall damage and management related costs of the IAS as a whole.

Coypu (*Myocastor coypus*)

Muskrat (*Ondatra zibethicus*)

[2]Haubrock *et al.* (2021) Economic costs of invasive alien species across Europe. *NeoBiota* 67, 153-190, doi: 10.3897/neobiota.67.58196

# Economic impacts

*Myocastor coypus* © Avish Bosh, (CC BY-NC-ND 2.0) via Flickr

The **coypu** (*Myocastor coypus*) is a semi-aquatic rodent native to South America, now widespread throughout Europe. Significant economic impacts arise from the species' burrowing behaviour, which destabilises riverbanks and flood protection structures. Additionally, coypu feeding strategies can damage food crop production. The associated costs are high, for example in a six-year period in Italy (1995 – 2000), coypu damage cost over €11 million, and over €2 million for control activities. It should also be noted that the burrowing activities for coypu often overlap with those of muskrat (*Ondatra zibethicus*), meaning the costs are enhanced.

The **golden mussel** (*Limnoperna fortunei*) is a freshwater bivalve native to south-east Asia. The species is not yet present in the EU, but is listed on the EU list of IAS of Union concern as of July 2022. This is due to the golden mussel's extreme fouling capabilities, which impact mechanical structures such as power stations and water-treatment plants by obstructing pipes and increasing the corrosion of metallic surfaces. In its invaded range in South America, the mussel is also known to pollute fresh waterways due to high mortality. The costs associated with managing the golden mussel are high, for example management costs were estimated to be more than $140 million across nearly 50 sites in South America between 1980 and 2020.

*Limnoperna fortunei* © andreaargentinat, (CC BY-NC) via iNaturalist

*Koenigia polystachya* © Vinayaraj, (CC BY-SA 4.0) via Wikimedia Commons

**Himalayan knotweed** (*Koenigia polystachya*) is perhaps less well-known than the similar Japanese knotweed (*Reynoutria japonica* syn. *Fallopia japonica*). Nevertheless, this perennial plant is associated with high levels of damage to infrastructure once established. Himalayan knotweed is native to Asia, but is now present in multiple EU Member States. One of the primary issues associated with this species is the impacts to home sellers and buyers, as the plant is capable of forming dense stands, coupled with a sprawling network of rhizomes, meaning successful eradication is both difficult and costly to achieve. Studies of knotweed control generally focus on the *Reynoutria* genus, but as costs for this can reach up to €80 per square meter per year, it is likely that *K. polystachya* management will also incur high costs. As with other knotweed species, and indeed IAS as a whole, preventing the species' establishment is a priority.

Volunteer work coordinator removing Himalayan balsam (*Impatiens glandulifera*) in Jyväskylä Finland, Finvasive LIFE (LIFE17/NAT/FI/000528) 

## It pays to tackle invasive alien species as early as possible...

The costs of managing IAS often increase significantly the longer time passes before action is taken. The most cost-effective way of addressing impacts from IAS is to prevent their introduction in the first place, e.g. through effective biosecurity. If this is not possible, then the costs to quickly detect and eradicate a new invasion are much less expensive than trying to eradicate, or control, an established and widespread IAS population.

In Germany for example, the costs of controlling American bullfrog (*Lithobates catesbeianus*) populations in five ponds were estimated at €270,000 annually. However, the authors projected that this figure could reach €4.4 billion if control measures required implementation throughout the entire country.

*Lithobates catesbeianus* © Thomas Berger, (CC BY-NC) via iNaturalist

# How

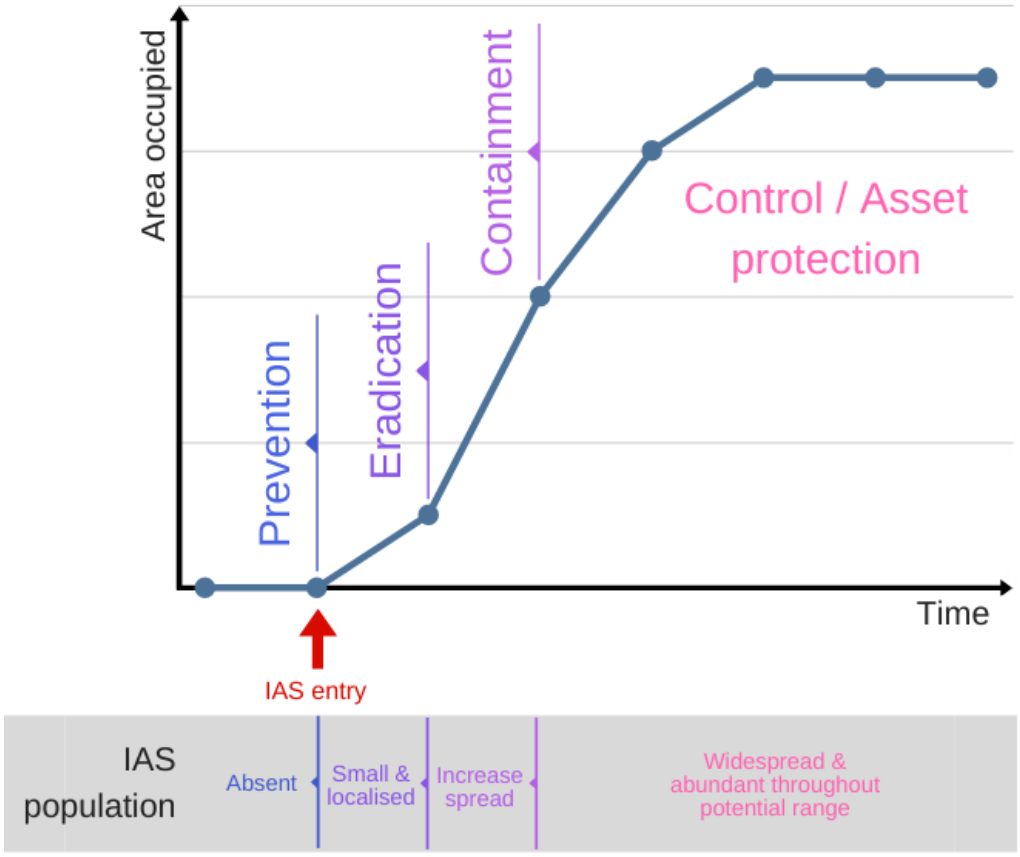
## can invasive alien species be managed ?

With regards to managing IAS and their impacts as a whole, the most cost-effective method is to **prevent** their introduction in the first place. This may be done by implementing strict surveillance and control measures in the form of biosecurity and legislation, and by addressing the pathways of introduction.

There are a number of general management objectives available to managers when tackling IAS once they have been introduced into the wild. These include rapid eradication, and the eradication, containment and control of established populations. **Rapid eradication** is an early intervention process, often termed 'early detection, rapid response'. This process is designed to locate and remove IAS populations (or even just one or few individuals) at an early stage of invasion, possibly before they begin to reproduce and spread.

If rapid eradication is unsuccessful, for example if the species remains undetected until populations are widely established, **eradication** can still be a feasible management option. It may however be costlier and more labour intensive than rapid eradication, given that the species had time to disperse widely or achieve higher population densities.

**Containment** is used when eradication is not feasible and aims to restrict the growth and dispersal of the population, limiting it to a defined geographical range. Finally, population **control** is also an option when eradication is not considered feasible, where the IAS is managed to keep population numbers below a threshold to mitigate impacts. It may be the case that containment and control will build up to becoming eradication measures over time.




Adapted from Invasive Plants and Animals Policy Framework, State of Victoria, Department of Primary Industries, 2010

# Action

## at the EU level

If IAS establish in one EU Member State, they may easily spread across borders to neighbouring countries. It is therefore strategic to tackle the problem at an EU level, as a coordinated response will have more effect than individual actions at Member State level. Therefore, on 22nd October 2014 the European Union adopted Regulation (EU) No 1143/2014 on the prevention and management of the introduction and spread of invasive alien species (the IAS Regulation), which entered into force on 1st January 2015.

The European Commission holds an Invasive Alien Species online resource, providing information on the IAS alongside details on Committees and expert groups, relevant acts, citizen science and information support systems.

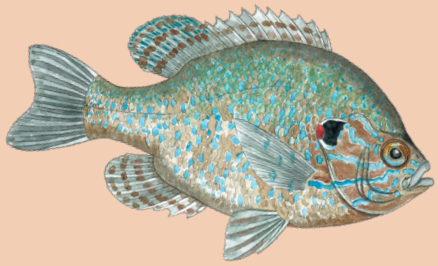
The Commission webpage also provides information on available financial support systems, including the LIFE programme, designed to support environmental, conservation and climate action projects while actively engaging in cross-border cooperation. Since its inception in 1992, the LIFE programme has co-financed more than 5,500 projects. Additional sources of funds include the Rural Development programme and Cohesion funds (inclusive of INTERREG funding), designed to support cooperation across regions and territories, and Horizon Europe, designed to promote innovation.



Project activities, LIFE INVASAQUA (LIFE17/GIE/ES/000515) © 2022 Fernando Cobo. All rights reserved. Licenced to the European Union under conditions.

## Linking invasive alien species management and EU Nature Directives

In addition to IAS-specific legislation, there are several EU Directives designed to protect the ecosystem and biodiversity upon which many of our ecological, social and economic activities depend. These include the Habitats and Birds Directives and the Marine Strategy Framework Directive. Further legislative outputs linking to biosecurity include the Plant and Animal Health Regulations.



Pumpkinseed (*Lepomis gibbosus)*

# EU Regulation

## on invasive alien species

The IAS Regulation establishes an EU-wide framework to prevent, minimise and mitigate the adverse impacts of IAS on biodiversity and ecosystem services. It focuses on taking actions against IAS that are included on a list of Union concern which is periodically updated. IAS are only added to the Union list following a risk assessment process.
The Regulation includes three distinct types of measure, which follow a hierarchical approach to combatting IAS:

**1. Prevention:** Member States must prevent new IAS from being introduced, either intentionally (e.g. bans on importing, selling, breeding) or unintentionally. Member States are required to carry out detailed analyses of the pathways of unintentional introduction to their territories. The purpose of this is to identify those which require priority action, due to either the volume of species or the potential damage caused by the IAS entering the Union through these priority pathways. Implementing clear and comprehensive biosecurity protocols will be the most efficient way of preventing introductions.

**2. Early detection and rapid eradication:** Member States must put in place a surveillance system to detect the presence of IAS as early as possible and take rapid measures to prevent their establishment. Early detection and rapid eradication are integral to the IAS Regulation, meaning Member States must maintain high-functioning surveillance systems to collect and record data on IAS of Union concern in their territory. Efficient networks for prompt reporting and a clear attribution of roles and responsibilities are a necessity, to act promptly when new detections are reported. This combination of early detection and rapid response is key, for example upon confirming the presence of population of American skunk cabbage (*Lysichiton americanus*) in Luxembourg in 2022, the plants were manually pulled and completely removed.

The EASIN Notification System (NOTSYS) is the official platform for EU Member States to notify the Commission and other Member States of IAS detections, as required by the IAS Regulation. NOTSYS is designed to facilitate a rapid, comprehensive notification of new detections of IAS of Union concern and any related eradication measures. The mandatory requirements can be enhanced with additional documents and spatial data. Upon validation, this information will be used for updating the EASIN Catalogue and spatial database.

*Lysichiton americanus* © Andrew Coombes, (CC BY-ND 2.0) via Flickr

**3. Management:** Some IAS of Union concern are already established and widely spread in certain Member States. Management action, often long-term, is needed to contain further spread and to minimise the harm they cause. The IAS Regulation specifies that within 18 months of an IAS being included on the Union list, Member States must have in place effective management measures for species found to be widely spread on their territory. Measures shall be prioritised based on risk evaluations and cost effectiveness. In applying management measures, Member States must ensure target animals are 'spared any avoidable pain, distress or suffering without compromising the effectiveness of the management measure'. This is irrespective of the stage of invasion, from rapid eradication attempts through to long term management. Managers should always strive to apply a measure with the lowest welfare impacts, without compromising the effectiveness of the management objective. A manual for the management of vertebrate IAS of Union concern (listed as of December 2021) is available to help incorporate animal welfare into management measures.

Documenting successful eradication measures is a vital component of management, as this allows stakeholders to learn from each other's experiences. One such example is the successful eradication of a suburban population of Pallas's squirrel (*Callosciurus erythraeus*) in Flanders, northern Belgium. The campaign took over five years at a cost of approximately €200,000 and included post-eradication surveying.

Member States should coordinate their IAS management plans across national borders. This is particularly beneficial when the risk of a species spreading between countries is high, or on occasions where concerted action will lead to a more cost-effective result. Additionally, measures should be taken to restore any habitats that have been damaged or destroyed by IAS, to hasten their recovery and prevent any subsequent re-invasions.

### Selected IAS Regulation Articles

- Preventing intentional introductions [Art. 7 *Restrictions*; Art 15. *Official controls*]
- Preventing unintentional introductions [Art 13. *Action plans on the pathways of invasive alien species*; Art 15. *Official controls*]
- Early detection and rapid eradication [Art. 14 *Surveillance system*; Art. 16 *Early detection notifications*; Art. 17 *Rapid eradication at an early stage of invasion*]
- Management of Invasive Alien Species that are widely spread [Art. 19 *Management measures*; Art. 20 *Restoration of the damaged ecosystems*]

## Identifying invasive alien species

Accurately identifying IAS in the field can be difficult, therefore surveillance guides are available for some species of Union concern to help those involved in their detection and management to confidently identify species and apply effective management measures. There are also guides that help the identification of alien species at customs, to increase the efficiency of official controls at entry points, and prevent their introduction in a Member State.

Pallas's squirrel (*Callosciurus erythraeus*)

# Guide to the EU Regulation on Invasive Alien Species

1143/2014

## Regulation applies to:

**All** invasive alien species (IAS) *
- Introduced outside natural range
- Live specimens that may reproduce
- Adversely impact biodiversity and related ecosystem services

### Listing criteria:

- Alien to the Union (exc. outer regions)
- Capable of establishing & spreading in >2 Member States or 1 marine region
- Adverse impacts to biodiversity & ecosystem services
- Risk Assessment shows concerted action at Union level required
- Inclusion on the *Union List* will effectively prevent, minimise or mitigate impacts

## List of IAS of Union concern

### 'Union List' = 88 species

2016 = 37 species listed (23 animals and 14 plants)
2017 = 12 species listed (3 animals and 9 plants)
2019 = 17 species listed (4 animals and 13 plants)
2022 = 22 species listed (17 animals and 5 plants)

Prevention measures

**Restrictions**
- IAS of Union concern shall not intentionally be; brought into the Union, kept, bred, transported, sold, used or exchanged, permitted to reproduce, grown or cultivated, released into the environment

**Action plans**
- Pathways analysis of unintentional introduction for IAS of Union concern
- Pathway action plans implemented for priority pathways (within 3 years of adoption)

**Permits**
- Permits issued by MS allowing for research or ex-situ conservation activities

**Authorisations**
- In exceptional cases for reasons of compelling public interest (incl. social or economic) MS may permit activities
- Authorisation required from Commission

Management of widespread IAS

**Management**
- MS have in place effective management measures for IAS of Union concern that are widespread in their territory (18 mo. of adoption)
- Based on cost-benefit analysis

**Restoration**
- MS carry out re-storation to assist ecosystem recovery degraded by IAS of Union concern
- Based on cost-benefit analysis

Prevention measures

**Emergency measures**
- For IAS of imminent risk of introduction not on *Union List*
- IAS need to likely meet *criteria* for inclusion on *Union list*
- Member States (MS) may apply temporary *Restrictions*
- MS must notify Commission - to decide if apply EU wide
- MS must carry out Risk Assessment and submit for inclusion on *Union List*

**IAS of Member State/regional concern**
- MS may establish a national list of IAS and apply *Restrictions* and other measures at national level
- For IAS that require enhanced regional co-operation MS may request Commission to require MS concerned to apply the following measures: Action plans, Surveillance, Early detection, Rapid eradication, Management, and Restoration

* Regulation 1143/2014 scope excludes:
- Species that expand range without human intervention
- Non-native species covered by other EU legislation

Early detection and rapid eradication

**Surveillance**
- MS establish a surveillance system for IAS of Union concern
- Needs to able to rapidly detect new introductions

**Controls**
- MS have in place risk-based controls to goods imported to verify they are not on the Union List or are covered by a valid Permit

**Early detection notification to EC**

**Rapid eradication**
- MS undertake eradication (complete & permanent) within 3 months of notification
- Methods used with due regard to human health, environment and animal welfare

**Derogations**
- Within 2 months of detection, MS may not eradicate if one of the following apply:
  - Technically unfeasible
  - Cost-benefit analysis show costs disproportionate to benefits
  - Eradication methods not available or have serious impacts to human health or environment
- Can be rejected by Commission within 2 months

Adapted from IUCN

# Invasive

## alien species of Union concern

At the core of the EU IAS Regulation is the **list of Invasive Alien Species of Union concern** – the Union list. The first Union list entered into force in August 2016, and has been updated periodically to include 88 species as of 2022 (47 animal species and 41 plant species).

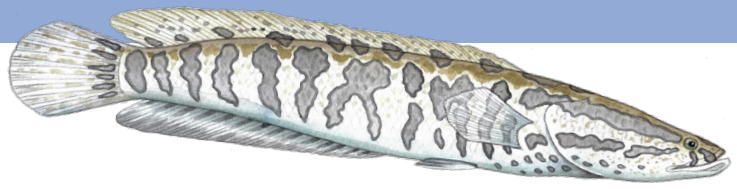
The decision to list a species as an IAS of Union concern is determined by an evidence-based risk assessment. These assessments must be completed according to agreed criteria, thereby ensuring that the results are valid for the whole of the EU and will only need to be undertaken once. Both Member States and the European Commission can propose species for inclusion on the Union list. A Committee, representing all Member States, will evaluate each risk assessment to decide whether the species should be included in the Union list. Species on the list are banned, and Member States will be required to undertake measures to ensure they are not introduced, traded, kept, bred or released in the EU.

Amur sleeper (*Perccottus glenii*)

Fountain grass (*Pennisetum setaceum*)

## Managing invasive alien species in the EU Outermost Regions

The EU's Outermost Regions are significant hotspots of biodiversity and they too are under threat from IAS, particularly on island ecosystems. Member States with Outermost Regions are asked to identify IAS that are problematic, and adopt a list of invasive alien species of concern for those regions.



Northern snakehead (*Channa argus*)

# List

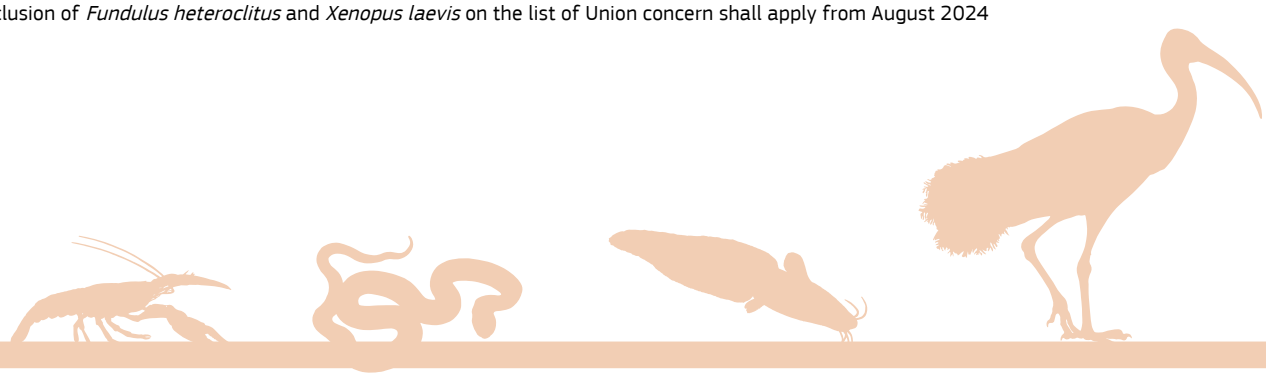
## of invasive alien animals of Union concern (2022)

| Scientific name | Common name |
|---|---|
| *Acridotheres tristis* | Common myna |
| *Alopochen aegyptiaca (Alopochen aegyptiacus*)* | Egyptian goose |
| *Ameiurus melas* | Black bullhead |
| *Arthurdendyus triangulatus* | New Zealand flatworm |
| *Axis axis* | Chital |
| *Callosciurus erythraeus* | Pallas's squirrel |
| *Callosciurus finlaysonii* | Finlayson's squirrel |
| *Channa argus* | Northern snakehead |
| *Corvus splendens* | Indian house crow |
| *Eriocheir sinensis* | Chinese mitten crab |
| *Faxonius limosus (Orconectes limosus)* | Spiny-cheek crayfish |
| *Faxonius rusticus* | Rusty crayfish |
| *Faxonius virilis (Orconectes virilis)* | Virile crayfish |
| *Fundulus heteroclitus*** | Mummichog |
| *Gambusia affinis* | Western mosquitofish |
| *Gambusia holbrooki* | Eastern mosquitofish |
| *Herpestes auropunctatus (Herpestes javanicus*)* | Small Asian mongoose |
| *Lampropeltis getula* | Common kingsnake |
| *Lepomis gibbosus* | Pumpkinseed |
| *Limnoperna fortunei* | Golden mussel |
| *Lithobates catesbeianus* | American bullfrog |
| *Morone americana* | White perch |
| *Muntiacus reevesi* | Muntjac deer |
| *Myocastor coypus* | Coypu |

| Scientific name | Common name |
|---|---|
| *Nasua nasua* | Coati |
| *Nyctereutes procyonoides* | Raccoon dog |
| *Ondatra zibethicus* | Muskrat |
| *Oxyura jamaicensis* | Ruddy duck |
| *Pacifastacus leniusculus* | Signal crayfish |
| *Perccottus glenii* | Amur sleeper |
| *Plotosus lineatus* | Striped eel catfish |
| *Procambarus clarkii* | Red swamp crayfish |
| *Procambarus virginalis (Procambarus fallax* f. *virginalis)* | Marbled crayfish |
| *Procyon lotor* | Raccoon |
| *Pseudorasbora parva* | Stone moroko |
| *Pycnonotus cafer* | Red-vented bulbul |
| *Sciurus carolinensis* | Grey squirrel |
| *Sciurus niger* | Fox squirrel |
| *Solenopsis geminata* | Tropical fire ant |
| *Solenopsis invicta* | Red imported fire ant |
| *Solenopsis richteri* | Black imported fire ant |
| *Tamias sibiricus* | Siberian chipmunk |
| *Threskiornis aethiopicus* | Sacred ibis |
| *Trachemys scripta* | Red-eared, yellow-bellied and Cumberland sliders |
| *Vespa velutina nigrithorax* | Asian hornet |
| *Wasmannia auropunctata* | Little fire ant |
| *Xenopus laevis*** | African clawed frog |

* Scientific name as indicated in the Commission Implementing Regulation

** Inclusion of *Fundulus heteroclitus* and *Xenopus laevis* on the list of Union concern shall apply from August 2024



# List

## of invasive alien plants of Union concern (2022)

| Scientific name | Common name |
|---|---|
| *Acacia saligna* | Golden wreath wattle |
| *Ailanthus altissima* | Tree of heaven |
| *Alternanthera philoxeroides* | Alligator weed |
| *Andropogon virginicus* | Broomsedge bluestem |
| *Asclepias syriaca* | Common milkweed |
| *Baccharis halimifolia* | Eastern baccharis |
| *Cabomba caroliniana* | Fanwort |
| *Cardiospermum grandiflorum* | Balloon vine |
| *Celastrus orbiculatus*** | Oriental bittersweet |
| *Cortaderia jubata* | Purple pampas grass |
| *Ehrharta calycina* | Perennial veldtgrass |
| *Elodea nuttallii* | Nuttall's waterweed |
| *Gunnera tinctoria* | Chilean rhubarb |
| *Gymnocoronis spilanthoides* | Senegal tea plant |
| *Hakea sericea* | Needle bush |
| *Heracleum mantegazzianum* | Giant hogweed |
| *Heracleum persicum* | Persian hogweed |
| *Heracleum sosnowskyi* | Sosnowsky's hogweed |
| *Humulus scandens* | Japanese hop |
| *Hydrocotyle ranunculoides* | Floating pennywort |
| *Impatiens glandulifera* | Himalayan balsam |
| *Koenigia polystachya* | Himalayan knotweed |
| *Lagarosiphon major* | Curly waterweed |

| Scientific name | Common name |
|---|---|
| *Lespedeza cuneata* | Chinese bushclover |
| *Ludwigia grandiflora* | Water primrose |
| *Ludwigia peploides* | Floating primrose willow |
| *Lygodium japonicum* | Japanese climbing vine |
| *Lysichiton americanus* | American skunk cabbage |
| *Microstegium vimineum* | Japanese stiltgrass |
| *Myriophyllum aquaticum* | Parrot's feather |
| *Myriophyllum heterophyllum* | Broadleaf watermilfoil |
| *Parthenium hysterophorus* | Whitetop weed |
| *Pennisetum setaceum* | Fountain grass |
| *Persicaria perfoliata (Polygonum perfoliatum)* | Asiatic tearthumb |
| *Pistia stratiotes*** | Water lettuce |
| *Pontederia crassipes (Eichhornia crassipes*)* | Water hyacinth |
| *Prosopis juliflora* | Mesquite |
| *Pueraria montana var. lobata* | Kudzu vine |
| *Rugulopteryx okamurae* | Okamura's brown alga |
| *Salvinia molesta* | Giant salvinia |
| *Triadica sebifera* | Chinese tallow |

* Scientific name as indicated in the Commission Implementing Regulation

**Inclusion of *Pistia stratiotes* and *Celastrus orbiculatus* shall apply from August 2024 and August 2027 respectively

**Invasive alien species of regional concern and species native to the Union (Article 11)**

Member States may identify additional IAS that are non-native to the Union, or native to parts of it, that require **enhanced regional cooperation**. At the request of the Member States involved, the Commission shall act to facilitate the cooperation and coordination among those Member States concerned.

If an IAS of regional concern is native to a particular Member State, then the provisions of the IAS Regulation will not apply in that territory. However, the Member State should always consult with others to assess the potential pathways of introduction elsewhere in the region and adopt relevant measures (where necessary) to avoid further spread.

**Invasive alien species of Member State concern (Article 12)**

Member States may establish a **national list of IAS of Member State concern**, which refers to IAS other than IAS of Union concern. For these species, Member States may apply in their territory measures such as those provided for in the IAS Regulation, ensuring their proposed actions are in accordance with the legal framework.

## What if a species is not on the EU Union list?

It remains each Member State's responsibility to tackle IAS that are present on their territory but are not listed as species of Union concern. Interim measures are available for Member States who may be concerned about the presence – or the risk of entry into their territory – of species that are not yet listed as being of Union concern, but appear to be highly invasive.

In such cases Member States may take emergency measures to address or prevent the entry of the species in question, while the risk assessment is performed (for potential inclusion on the Union list). In such cases, the Member State concerned will need to inform the Commission and other relevant countries so that they can react accordingly.

# Raising awareness of IAS and the Regulation

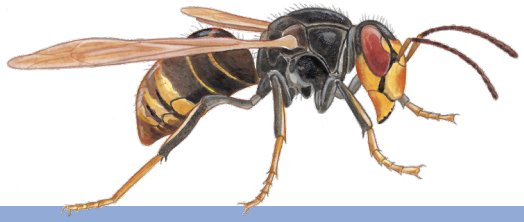
Through an EU wide project "Invasive alien species: improvement of understanding and communication" a series of stakeholder engagement platforms were run to improve dialogue and understanding across sectors representing major pathways of introduction; pets, aquatic ornamentals, forestry, soils transport and aquatic recreation. The key outputs of this EC funded project are a series of campaigns targeting these sectors, with the aim of improved understanding of measures that can be taken to reduce the risk of introducing and spreading IAS. The campaign material can be found on EASIN.


Campaign material for raising awareness about IAS in the aquatic ornamental sector

# Managing invasive alien species to protect EU biodiversity

Addressing the impacts of IAS feeds into the EU Biodiversity Strategy for 2030, an ambitious, long-term plan aiming to reverse ecosystem degradation and set European biodiversity on a road to recovery by 2030. Tackling IAS is a priority within the Strategy, with one of the key commitments by 2030 stating that 'There is a 50% reduction in the number of Red List species threatened by Invasive Alien Species'.

*Rhododendron ponticum* © Alexey Chernyak (Черняк Алексей Леонидович), (CC BY-NC) via iNaturalist



## Managing invasive alien species to protect pollinators

The Asian hornet (*Vespa velutina nigrithorax*), native to south-east Asia, was likely introduced to Europe through the horticultural trade in 2004. It is a highly effective predator of both wild pollinator populations and honeybees. Asian hornet colonies produce an average of 6,000 individuals each summer, impacting pollinator services in general and leading to significant beehive declines.

Unfortunately, there are numerous further examples of IAS, animal and plant, impacting wild pollinators through competition, predation, poisoning/toxicity and disease transmission (among others). An example of this is the common rhododendron (*Rhododendron ponticum*) which, although partly native in the EU (and not included in the Union list), is an aggressive coloniser in its invaded range and is only available as a food source to pollinators that can tolerate the neurotoxin it produces.

*Vespa velutina* © Danel Solabarrieta, (CC BY-SA 2.0) via Wikimedia Commons

# Regulating

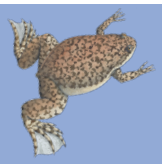
## intentional trade

As a result of the Regulation's focus on prevention, it is **illegal to intentionally bring into the EU any species listed as an IAS of Union concern**. Customs authorities are mandated to carry out controls at all Union borders and have the authority to seize any shipments that do not comply with the IAS Regulation. Furthermore, the **possession, breeding, use, transport, sale or release into the environment of any IAS of Union concern is also banned**.

Exceptions to this rule are available for research or ex-situ conservation purposes. However, this is subject to stringent conditions, including the issue of permits by the competent authorities within the Member States concerned. In addition, in exceptional cases, for reasons of compelling public interest (e.g. economic), authorisations can be given to derogate from the restrictions set out by the IAS Regulation. Under such activities, it is vital that certain conditions are respected, such as keeping the specimens in closed facilities.

On occasion, the accurate identification of IAS can be challenging. As a result, the European Commission has provided support for managers, customs officers, national authorities, researchers and citizens to identify IAS of Union concern and learn more about their impact and management. This support can be found on EASIN and also on the EC IAS online resource.

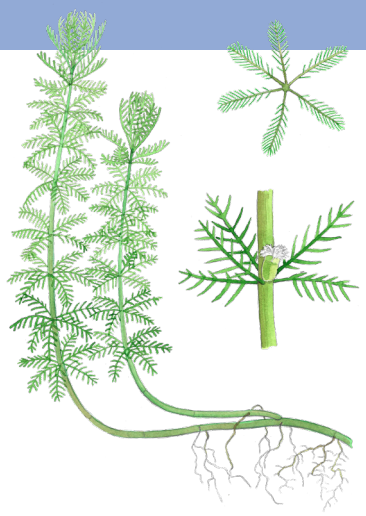
Efforts will always be made to facilitate training and communication, indeed Article 15 of the IAS Regulation states that *'the Commission, together with all Member States, shall develop guidelines and training programmes to facilitate the identification and detection of invasive alien species of Union concern and the performance of efficient and effective controls'.*



## Support for customs controls

The Identification of invasive alien species of Union concern during customs control guides have detailed descriptions of species of Union concern, and methods to distinguish them from other, similar species. These descriptions include guides to distinguish numerous squirrel and crayfish species, both of which have multiple representatives on the Union list, in addition to many plant species.

African clawed frog (*Xenopus laevis*)



Parrot's feather (*Myriophyllum aquaticum*)

# Organising
## awareness-raising campaigns

The importance of raising awareness cannot be overstated, and indeed the IAS Regulation encourages Member States to establish awareness campaigns. These are important for detection, surveillance and monitoring, but also for improving adherence to biosecurity. Biosecurity can be incorporated into daily life in a multitude of ways, for example people ceasing to release pets and/or plants, or water users following 'Check-Clean-Dry' procedures.

Several Commission funded projects have had awareness raising activities at their core. For example, LIFE projects are usually characterised by a strong element of outreach, through which they consistently include engagement of key stakeholders and the general public. Additionally, COST actions such as the project 'Increasing understanding of alien species through citizen science (ALIEN-CSI)' seeks to establish a European-wide citizen science alien species network.

The LIFE ASAP Project was designed to reduce the numbers of IAS introduced to Italy, by promoting their effective management and encouraging the active participation of citizens. A strong focus of the project lies in training the staff of institutions such as protected areas, zoos, botanic gardens, museums and national parks on the subject of IAS. This is so they can use their daily contact with members of the public to spread an understanding of the correct behaviours to minimise and mitigate the spread of IAS. A further objective will be to work with the scientific community and produce a list of priority invasive alien species for Italy.

The ReLionMed-LIFE Project aimed to effectively manage the invasive of common lionfish *Pterois miles* in the Mediterranean Sea, particularly around the Cyprus coast. The project provided scope for citizens to engage on an immediate level, for example by using the Lionfish Portal to report lionfish sightings or, for experienced divers, by joining Removal Action Teams to participate in coordinated lionfish removals. These removals were strategic, in that they targeted Marine Protected Areas, Natura 2000 sites and lionfish hotspots. The project is an example of holistic management, as it involved multiple stakeholders and suggested novel ideas for what to do with the captured lionfish, for example providing recipes or making jewellery.

*Pterois miles* © Nic Xalk, (CC BY-NC-ND 4.0) via iNaturalist

EASIN also supports the efforts of those who wish to become Citizen Scientists, expanding the recording of IAS within their localities. Citizens can use the smartphone App 'Invasive Alien Species Europe' (available on the Apple iTunes and Google Play stores) to report IAS of Union concern. This App has been developed by the European Commission's Joint Research Centre, enabling citizens to contribute to early detections of new IAS. The resulting data undergoes a validation process and is then available for citizens to visualise and explore, both in their region and beyond.

# Key resources

**Information on IAS in Europe**

*The following information is available from the DG ENV IAS website: http://ec.europa.eu/environment/nature/invasivealien/index_en.htm*

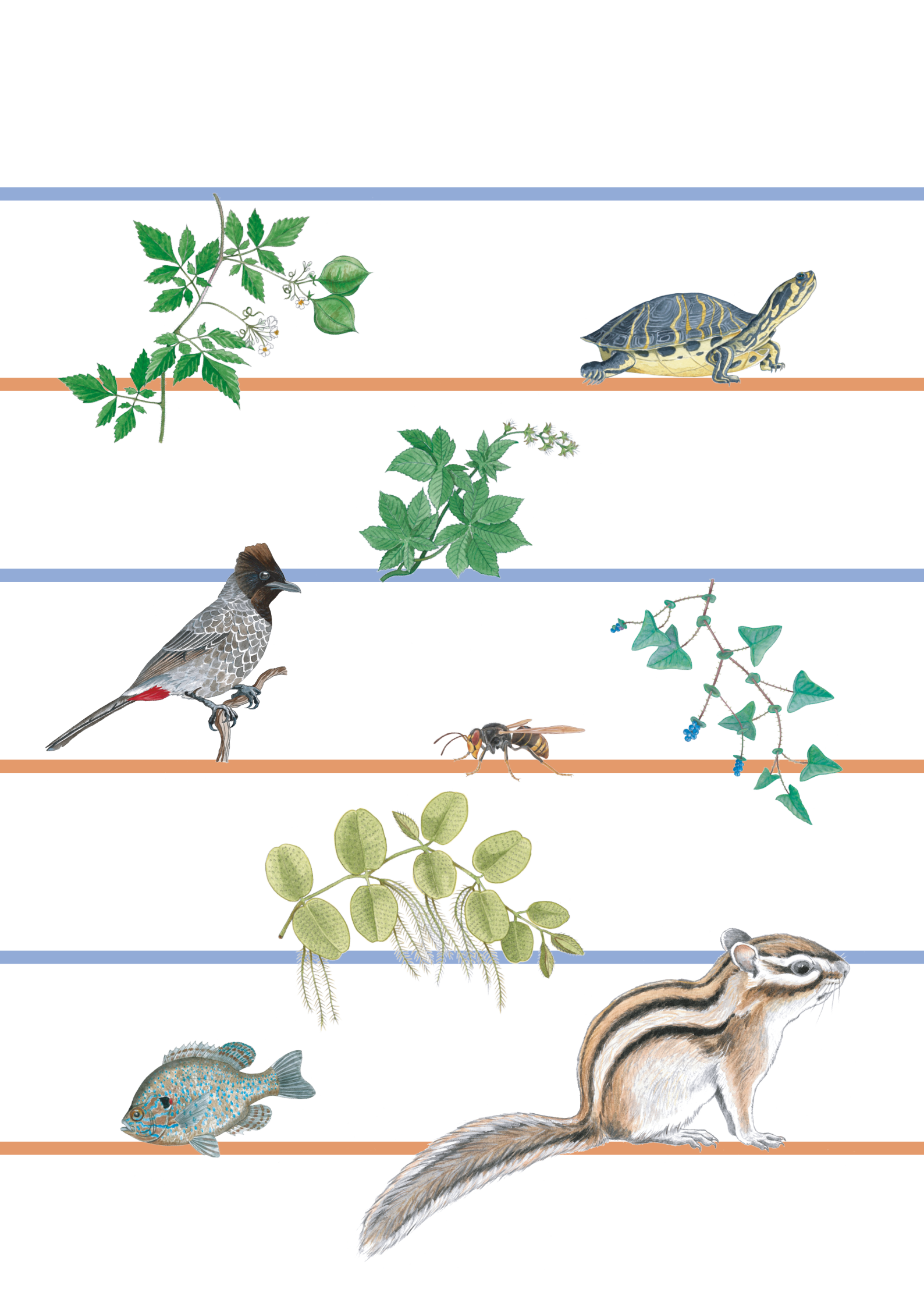
1. Regulation (EU) No 1143/2014 of the European Parliament and of the Council on the prevention and management of the introduction and spread of invasive alien species
2. Report on the Implementation of the Regulation on Invasive Alien Species (October 2021)
3. Committee and Expert Groups on Invasive Alien Species
4. Identification Guides, Management Information, Risk Assessments and other relevant information mobilised through service contracts for the European Commission
5. Financial Support Systems

**Information systems**

1. A European Alien Species Information Network: http://easin.jrc.ec.europa.eu
2. Global Invasive Species Database (GISD): http://www.iucngisd.org/gisd/
3. IUCN Environmental Impact Classification for Alien Taxa (EICAT): https://www.iucn.org/resources/conservation-tool/environmental-impact-classification-alien-taxa-eicat

**Useful links**

1. Guidance for interpretation of the CBD categories of pathways for the introduction of invasive alien species
2. Convention on Biological Diversity – Invasive Alien Species
3. Council of Europe Group of Experts on IAS



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