

Invasive species in our industry?

By Alex Ploeg, Secretary General of OFI

In a poll in our website www.fish.org in July/August we asked the visitors to our website how they estimated the effect of eventual legislation on Invasive Alien Species would affect our industry. The result was:

Yes, for sure:	66 %
Perhaps, but I am not sure:	17 %
No, I don't think so:	14 %
Don't know:	3 %

But how serious is the situation? May we expect legislation? Would legislation solve the problems? Do we have problems caused by our industry? How serious would legislation affect our industry?

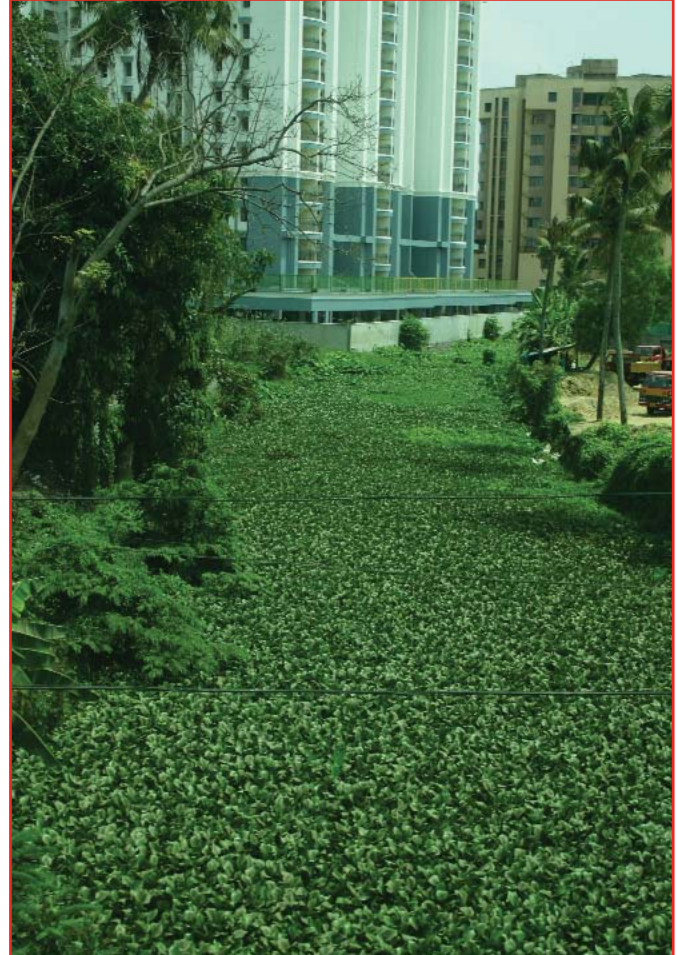
What is an Invasive Alien Species?

While talking about Invasive Alien Species (IAS) with scientists, government representatives, representatives of non governmental organizations we see that the interpretation of this differs from person to person, scientists to scientist and government to government. Not so much in theory but certainly in application. The Convention on Biological Diversity defines it as:

an alien species whose introduction and/or spread threaten biological diversity.

For this it is first necessary that a species (plant or animal) is introduced (by human activity) somewhere outside its natural range. Furthermore, it should establish itself, which involves reproduction, and it must spread itself. Last but not least, with spreading it must also be a treat to biological diversity. This sounds evident, however, we see that this definition is violated many times. In e.g. the United Kingdom the Water hyacinth (*Eichornia crassiceps*) is now considered to be an IAS and as such banned from import, despite the fact that the species cannot survive the English winter and as such is not able to establish itself and therefore does not meet the definition. In the Netherlands the Ring-necked Parakeet (*Psittacula krameri*) is often mentioned as an IAS by NGO's, and certainly it does reproduce and also spread. It does, however, not meet the criterion that it is a treat to biodiversity and thus should not be considered an IAS.

The CBD definition is also restrictive. It restricts the damage caused by IAS to an adverse effect on biological diversity. In most countries adverse effects on local animal health, human health and economy are also included. In the Netherlands the damages caused to the efficiency of waterways, crucial structures for our survival as a country, are taken into account. I must admit that this to me is very well acceptable.



Waterhyacinth (*Eichornia crassiceps*) closing off a river in Kochi, India.

Photo: Alex Ploeg

The ornamental aquatic industry as a pathway

There are many sorts of pathways for introduction of a potential IAS into an area. In general we can distinguish intentional and unintentional introductions. Intentional introductions are usually with an economic interest, for agricultural or aquacultural purposes. Aquaculture (and some part of the fishery) industry in many countries is based on species intentionally introduced like trout, tilapia and Nile perch. Sometimes these introductions were very successful with respect to the original aims of the introduction, but have very negative side effects. The Nile perch (*Lates niloticus*) in Lake Victoria was introduced for fisheries purpose and may indeed have been a success as far as fisheries purpose is concerned. Unwanted side effect was the possible extinction of many endemic cichlid species. Lion fish (*Pterois volitans*) were introduced into Florida water as a result of escapes after hurricane Andrew in 1992 and possibly also on purpose, as tourist attraction for divers at wrecks along the coast of Florida (<http://www.niiss.org/cwis438/websites/niiss/home/lionfish.php>). They developed strong and rapidly



Lion fish (*Pterois volitans*) now cause direct damage to the reefs along large parts of the Atlantic coasts of the USA. Photo: Svein A. Fosså

expanding populations, which now cause direct damage to the reefs along large parts of the Atlantic coasts of the USA. Other animals were introduced unintentionally in ballast water of ships, or attached to trucks travelling across several countries, and as stowaways in airplanes or in shipments of goods traded worldwide.

Our industry is generally considered by scientists and governments to be a serious potential pathway. Although many of us might have the feeling that this is ridiculous, we must realise that our industry indeed is a serious potential pathway. If we consider that our industry transports millions of specimens of several thousands of fish species, hundreds of plant species and also hundreds of shrimp, crab, lobster and snail species across all continents it is quite logical that it is considered to be a serious potential pathway. The species are often transported in quantities that are large enough to establish populations in places where they can survive. Of course ornamental aquatic animals and plants are not imported with the purpose of being released into the wild. In most countries this is even explicitly forbidden.

Routes to the wild

Nevertheless, animal and plants imported for the ornamental aquatic industry do end up in the wild. There are several routes for these introductions:

1) Application in open systems. Here we have to think especially of plants and animals in ponds. In general these plants and animals have to be able to survive local climatic conditions like. Ponds should be closed off from

natural waters, but unfortunately this is not always the case and some garden ponds are incorporated into natural brooks and creeks. Hobbyists may introduce alien plants and animals into the natural waters. Fish, shrimps, snails but also seeds and parts of plants may run off into other natural waters and start the dispersion of an alien species which may become invasive. In temperate zones this route for introduction seems to be very obvious, but in reality this hardly has led to any serious introduction of an IAS. In warmer climates this route would even be more obvious.

Nevertheless, also here I know of only a very few examples causing damage. But those few can become a major problem e.g. water plants: *Pistia stratiotes*, *Eichornia crassiceps*, *Hydrilla verticillata* *Ludwigia* spp., and *Elodea* spp.

2) Release to the wild. Here we have to do with several different mechanisms. Aquarium and pond lovers are in general people who love nature. They love nature so much that if they notice an overpopulation in their ponds or aquariums, they rather release the excess animals and plants into the wild than to destroy them. We must strongly support governments of e.g. Australia, United Kingdom, New Zealand and the USA, and colleague associations like OATA and PIJAC USA, who are already bringing this message to these pet lovers that release into the wild may cause very serious damage to natural population of plants, fish, shrimps, snails etc. It might be fun to find goldfish or sunfish in local waters, but goldfish



In waterways in many places in the tropical world we may find one of the most popular aquarium fish, the algae-eater *Hypostomus plecostomus*. **Photo: Aqualog**

in northern Europe might lead to crossbreeding with natural populations of *Carrassius auratus* and the sunfish (*Lepomis gibosus*) already has caused the extinction of amphibians in pools where they were released in e.g. the Netherlands. In these pools they eat all they can get, including all amphibian larvae, before they start preying on each other. In waterways in many places in the tropical world we may find one of the most popular aquarium fish, the algae-eater *Hypostomus plecostomus*. This algae eater grows much larger than suitable for most home aquariums, and no colleague aquarist is interested in a 30 cm Pleco. Reports of this fish as a serious plague are reported to the OFI Secretariat from the Philippines, Bangkok and Mexico, but most probably it will cause serious damage in many more tropical rivers. It may become so abundant that hardly any other fish is found in these rivers.

In temperate areas pond-plants released by pond-owners may cause serious problems for natural waters and canals. Especially some species of so-called "oxygen plants" have a very hardy nature and release of small fragments of these plants may result in established populations. Many of these will not survive a temperate winter, but they do withstand subtropical winters. Some even survive northern winters if these are not too cold and then spread easily. Clogging of waterways can be the result of escapes of *Ludwigia grandifolia* or *L. peploides* in countries in e.g. northern Europe. Some of these plants also lead to local extinction of endangered local flora in nature reserves and thus are a direct threat to biodiversity. In the Netherlands we have developed an agreement between industry, government

and other stakeholders not to import, produce and sell certain of these "oxygen plants" (*Ludwigia grandiflora*, *L. peploides*, and *Hydrilla verticillata*). It should enter into force in 2009.

In the United Kingdom there are strong indications that for religious (Buddhists) or for sentimental reasons some people purchase live fish, e.g. goldfish, with the explicit purpose to release these fish into the wild. The British governmental agency dealing with IAS, Defra, informed me that often in the direct vicinity of a pet shop that sell goldfish, the same goldfish varieties can be found in the wild. This is a serious report and shop keepers should be aware of this practice. A problem is that native fish may often not be sold as they are protected. A local alternative is thus not available due to strict national legislation.

Guppies are a special case. Guppies are known to love mosquito larvae and in many places in the tropical and subtropical world, guppies were and are released by governmental agencies to natural waters in order to fight mosquitoes. Usually these authorities are careful where they release the guppies, preferably in places where they know that guppies cannot establish viable populations, such as pools which will dry out later in the season.

- 3) Escapes to the wild in hobby systems. Escapes take place in a few ways: with water changes while emptying a tropical aquarium, with flooding of garden ponds, by active escape of the animals and by spreading of seeds in case of plants.

Although some scientists claim that, based on statistical



Hydrocotyle ranunculoides, Floating marshpennywort, is already forbidden in a number of countries. **Photo: J.L.C.H. van Valkenburg**

calculations, almost every imported species will eventually escape and can be found in the wild, there is no hard practical support that this theoretical model will lead to populations in the wild. There are many very good reasons for this. First of all, most imported tropical species will not be able to survive in the wild in many import countries due to temperature, climate or water quality demands. They immediately die when escaped to the wild. The risk of survival of such escaped species depends strongly on these characteristics, which vary with the latitude and specific climate circumstances of the import country.

Also many species of freshwater and marine organisms represent such a value for the trade and the hobbyists that they will take all measures to avoid escape.

Even if a few specimens would escape, they will need a certain minimum quantity to be able to form a reproducing population (propagule pressure). With unintentional escapes the likelihood that they reach this minimum is very small.

- 4) Escapes from closed production facilities. Ornamental fish, shrimp and snail production sites are usually located in tropical areas. Unfortunately many of these farms discharge water without any treatment and provide animals with all kinds of opportunities for escape. Fish may jump out of holding tanks, shrimps can climb out of tanks which are not properly covered and snails find the smallest holes to escape. Some of these escaped species may survive in the natural waters around the farms and the numbers may reach the volumes needed for forming reproducing populations. In the tropics seeds of plants may very well be fertile and the plants distribute themselves around the farms. We can find examples of such self maintaining populations of ornamental species around almost all tropical or subtropical production areas, e.g. in Florida, Bangkok, Singapore, Philippines, etc. In many cases established populations of *Hypostomus plecostomus* were results from such escapes. Also populations of mollies, guppies, platys and swordtails (cichlids) are well-known in such areas.

We may also find escapee populations in temperate areas, especially around producers of pond plants in warm water springs or outlets of powerplants..

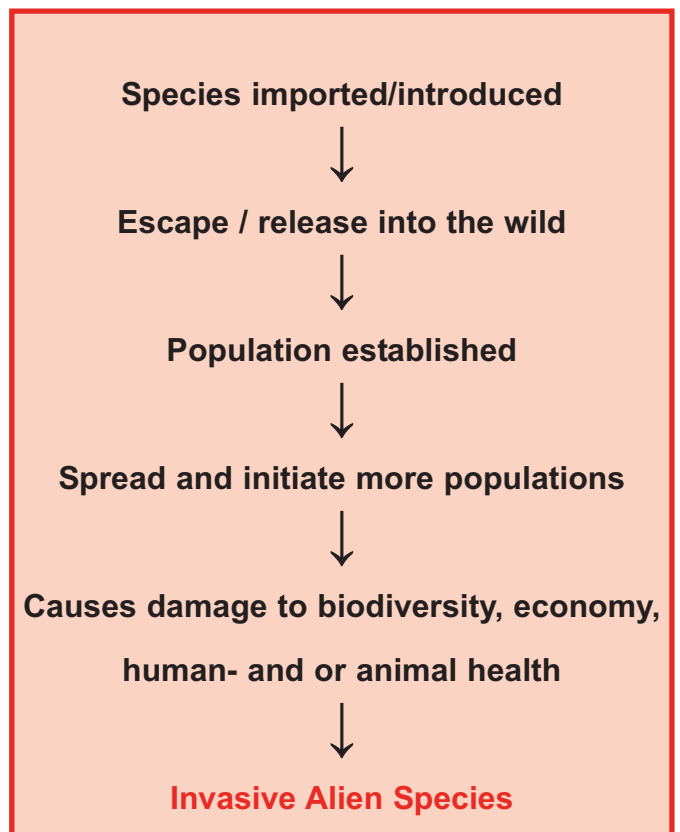
Invasive Alien Species?

As we have seen the risk that species imported through our industry will establish viable populations exists. However, not all of these populations are invasive. Many of them exist but do not spread, others do spread but do not cause more damage than by just being there. In the eyes of some purists this already is damage as they take the space of some native species. This is merely an academic discussion. In our eyes damage is only damage if you can quantify it and eventually express it in a value of money (e.g. cost of eradication, loss of production). Until now, for species



If a wide mesh screen is the only protection preventing escapes from culture ponds, the risk for introduction of cultures animals into the wild is high.
Photo: Alex Ploeg

introduced for ornamental purposes, cases are mainly known for tropical areas. In these areas, however, often governments do no (yet) bother so much about it as they have other priorities. This does not mean that the problems are less serious; it is simply a matter of capacity to fight national problems.



To make a species an Invasive Alien Species, it must pass several stages.

Species	Common name	Country	Damage	Total costs in Euro/year
<i>Aphanomyces astaci</i>	Crayfish plague	Norway	Costs of import	160.000
<i>Gyrodactylus salaris</i>	Salmon fluke	Norway/Scotland	Loss of stock, eradication	32.580.000
<i>Procambarus clarkii</i>	Red Crayfish	Portugal	Loss of rice yield	2.210.000
<i>Hydrocotyle ranunculoides</i>	Floating Pennywort	Netherlands	Control	3.000.000
<i>Fallopia japonica</i>	Japanese knotweed	Several countries	Control, eradication, etc.	1.109.910
<i>Odatra zibethicus</i>	Muskrat	Netherlands, Germany	Damage to riverbanks, control, eradication	46.160.000
<i>Sciurus carolinensis</i>	Grey Squirrel	UK	Control and eradication	460.000

Some Invasive Alien Species and the damage they cause in Europe.

Source: IEEP, 2008

Legislation / voluntary schemes

Since many years the IAS problem has been on the agenda of the Convention on Biological Diversity (CBD). All parties of the CBD have recognized IAS as a serious problem that should be addressed. Several countries have already implemented legislation to prevent imports of potentially invasive species. Until now mainly island states were able to implement such measures as there the legislation is most easily enforced. The United Kingdom has implemented legislation to prevent the import of certain pond plants, many ornamental coldwater fishes and almost all crayfish. Australia and New Zealand have also implemented a list of prohibited species. Israel has also implemented measures and also in the USA (Florida and Hawaii) have implemented measures, prohibiting for example Piranha's and Snakeheads. In other countries governments (for the moment) prefer voluntary schemes (Netherlands, Germany).

A serious problem in developing legislation is producing a screening system. This involves a risk analysis to predict whether a species can become invasive in a certain country or area, even before introduction. Currently systems are in place in e.g. Australia which uses historical data, specific characters of the species involved and comparisons of climatological circumstances in the country of origin and the country of introduction. This risk assessment has lead for instance to prohibit *Hypancistrus zebra* into Australia. Currently colleagues of the Pet Industry Joint Advisory Council (PIJAC) of the USA, in close cooperation with the Global Invasive Species Programme (GISP), are working on a comprehensive Toolkit for Best Prevention Practices and Management. This includes regulatory and non-regulatory measures to minimize the introduction of animals, plants, pathogens and parasites via the pet/aquaria trade pathway. It is extremely important that trade also takes the initiative to prevent species introduced into countries by our industry become invasive and cause direct damage.

In several countries voices are heard that the these imported the species should be made responsible for the damage. In other countries voices are heard (especially from scientists) that the only solution is an immediate direct total stop of all imports.

During the workshop at the University of Notre Dame, Indiana, USA in March 2008, which I attended on OFI's behalf, we discussed screening systems and possible

regulatory measures. In the eyes of many of the participants it should be appropriate that new species should only be allowed after a screening, based on risk assessments such as e.g. the Australian type described above. Others, fewer in number, would be in favour of making such screening obligatory for all species imported at present, which will involve a full stop of imports until the species is assessed and approved for imports.

The European Commission has organized several meetings on this topic with member states and stakeholders and several EU Member States, among which the largest countries, are in favour of strict regulation as well. Proposals involve white listing of approved species as well, also based on risk analysis.

Risks for industry

In my eyes it is not a question whether measures will be implemented in many countries or not, but when they will be implemented and how these measures will look like. In the worst case every country will develop regulatory measures on their own, all differing from each other in details, with different guarantees and different risk assessments. This would be the end of large parts of our industry.

We better get involved in this process and participate in projects like the development of the Pet Trade Pathway Toolkit to be developed by PIJAC and GISP. Let the risk analyses be based on actual risks and not on theoretical risk and let us contribute to a worldwide standard with which our industry can work. The OFI Executive Board has decided that OFI should participate in CBD activities as the CBD is currently the international platform for IAS developments.

OFI is currently seeking support for organizing a one-day Conference on this topic on the Saturday of Aquarama 2009. The aim is to create awareness of the IAS situation with respect to our industry among industry operators. It should furthermore start creating awareness on how we handle the species in our industry to prevent escapes and releases within the industry, but also among hobbyists. If you feel responsible for the future of our industry and want to contribute financially to the OFI Conference or to the PIJAC/GISP initiative, please contact the OFI Secretariat for more information.