

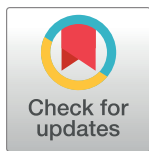
## OPINION

# Nothing can go wrong—Introduction of alien crayfish to Europe

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## Something went wrong, right?

An ecological disaster based on human ignorance of scientific facts: the deliberate introduction of alien crayfish to Europe is a classic case of solving an ecosystem problem created by a mistake by making another. The devastation of the native European crayfish populations was a result of accidental introduction of crayfish plague (*Aphanomyces astaci*) and general aquatic ecosystem destruction by industrialisation [1]. To revive crayfisheries, massive introductions of alien crayfish were initiated in the 1960s resulting in further crayfish plague epidemics, all native European crayfish facing extinction and finally even alien signal crayfish wild stocks collapsing. Better off now? No. We are worse off than before the age of alien freshwater crayfish [1].

The common inability to learn from mistakes and history [2] is the fundamental base for the repetitive alien species introductions and its catastrophic outcomes. It is hard to understand how failed actions can be repeated with the assumption that this time it would be a success. This principle should be widely known and accepted since even Muumin pappa states: It is stupid to make the same mistake twice!

We believe that the conservation of native species and ecosystems should not be based on short term economic motivations justifying alien species introductions. The time frame must be adapted to that of natural ecosystem functions, and even to the evolutionary time scale if natural ecosystems are to be managed. This means that the ecosystem management, or rather manipulation, requires thorough risk assessment and considerations from the whole ecosystem impact point of view [1]. This would restrict or totally hinder most planned ecosystem management projects, as their impact is either impossible to assess or is plain risky. We are supporting the Weser ruling principle [3], stating that a deterioration of the recipient's status for a single quality element or substance is not allowed and the EU water framework directive objectives must be applied to assess whether a species is admissible or not. We argue that the same principle should be applied to whole ecosystems including environment, flora and fauna.

## Alien species do not work

It is rather clear that the repetitive introductions of alien species for apparently justified reasons frequently turns into a disaster [e.g., 4]. The alien species routinely carry diseases and parasites. They normally cause havoc to native ecosystems by having invasive features, thus

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causing radical disturbance [e.g., 5]. If the alien species turn invasive, such introductions often end up in economic losses [e.g., 6] rather than practical or economic benefits.

The introduction of the signal crayfish (*Pacifastacus leniusculus*) to Fennoscandia was done knowing that the diseases and parasites of this alien species would also be introduced. As a classic example of ignorance, the import ban administered by the Finnish national veterinary institute was coldly bypassed during the 1960s [7]. In Sweden the disease issue was known when the massive introductions to the natural waters started [1]. Despite the risks, the alien species promotion was active. Under Fennoscandian conditions, the alien signal crayfish has maladapted and their wild stocks are struggling. The same applies to Spain, where the promotion of the fisheries of both signal crayfish and the red swamp crayfish (*Procambarus clarkii*) by local governments and the inaction of the Ministry basically have resulted in the extinction of the native crayfish species [8].

The alarming fact is that the government institutions responsible for the natural resources and ecosystems were not reacting appropriately to the alien crayfish species disaster. The introductions were not properly prepared with no or minimal risk analyses and quite often totally sidelining clearly presented and justified concerns. There are several examples from Europe of plain ignorance and arrogance in the form of promotion of the alien crayfish species against research data and common sense [1, 9] including definition twisting, loophole utilization, data cherry picking and placing misinformation to common public. In our opinion, those government institutions actually responsible for the native ecosystem protection did not do their job properly.

Currently, all native European crayfish are on the brink of extinction. However, further introduction of alien crayfish, facilitated by the poorly regulated pet trade in the EU, pose a constant epidemical pressure on native crayfish by repetitively introducing new disease strains. This obstructs the adaptation of the crayfish towards the disease [e.g., 10]. The detrimental consequences of these pets being released to the wild are not limited to crayfish, but spread through the whole freshwater ecosystem [e.g., 11].

## Education is the key

How to counteract the alien crayfish problem in Europe has been extensively reviewed in [1]. We believe that, apart from basic and applied research on management and biocontrol of alien crayfish and the crayfish plague disease agent, as well as strict and enforced European pet trade regulations, awareness raising of the common public is essential for an effective long-term change of the common anthropocentric mindset. Education of the laypersons, including school children, retailers, fishermen and pet owners, reduces the probability of alien crayfish species release into the inland waters. This is especially true for the areas where alien crayfish are not yet present but could spread. Once informed and more aware of the negative impacts of alien crayfish species, general public engagement can significantly contribute to nature conservation [12].

For this goal, we have created an educational animation for past, present and future children and youngsters and all those interested in the fascinating and complicated history of freshwater crayfish in Europe. *The Crayfish Tale* [13] introduces freshwater crayfish and their fundamental role as keystone species, tells about the mistreatment of native crayfish, and advices how we humans must behave in order not to finally lose these essential species and the wellbeing of our freshwater ecosystem. The animation has already been translated to several European languages.

To conclude, invasive alien species are one of the main drivers for biodiversity loss, and if we do not counteract quickly, nature will collapse and the economy will too [14]. We have to

get away from an anthropocentric view of nature [15], since we are a part of the global ecosystem. Our existence on the planet depends on an equilibrium of billions of taxa that evolved for billions of years, and we disturbed them as seen in the case of alien crayfish introduction to Europe, where, as we know now, everything went wrong. But if we start to look after our crayfish and waters, the future will look after us.

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