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The European catfish (Silurus glanis) as an invasive species – eDNA detection methods

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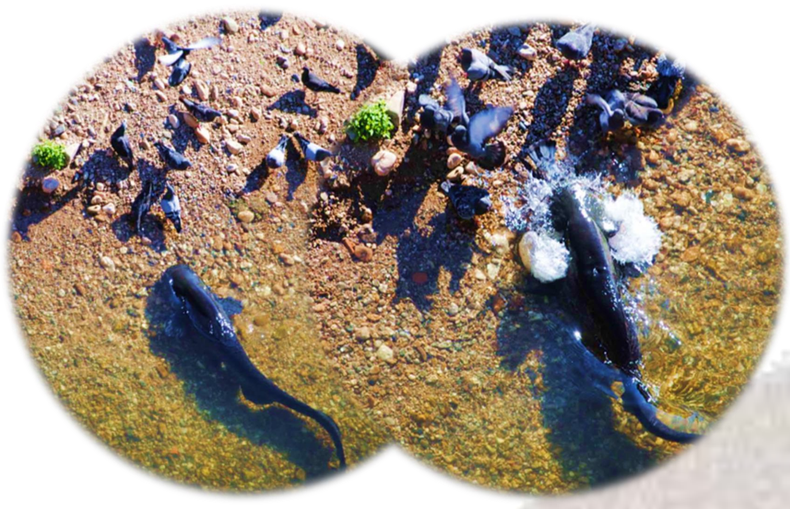

Figure 1. A *S. glanis* attacks pigeons on land
(Source: Cucherousset et al., 2012)

Introduction

The European or Wels catfish *(Silurus glanis)* is an opportunistic apex predator, and one of the largest freshwater fish species in Europe, making it a popular choice as an angler fish or biological control agent. Moreover, they have become increasingly important in the food industry of some area over the last few years. But it is a very adaptable fish with a broad diet and thus has a profound impact on the ecosystem. Because of these reasons, it became an invasive species in several countries where it was introduced, so they need to be monitored. For this, besides the traditional methods, with the recent technological advances (for example the New Genome Sequencing - NGS), non-invasive, sensitive, cost- and time-effective approaches have emerged that utilize eDNA (environmental DNA) as a basis for monitoring in natural waters. This eDNA includes all of the genetic material released by different organisms into their environment.
The aim of this poster is to present these recent technologies and their application to European catfish species.

Material and method

The literature reviews for this research were conducted in 2023 April, using the Google Scholar Web search engine. We made a condition that it searches the whole literature and only shows those in which all keywords ('invasive' *'Silurus glanis*' 'environmental DNA') were present. With these conditions, it produced 637 results, so we first narrowed them down to articles published or available for early access from 2018 to April 2023 at the latest, in English language. After these steps, 273 pieces of literature remained whose content was personally screened. While we processed these literatures, we also included their older references in this review, but the methods discussed are all from the last 5 years. From there, we used those, which were published in journals with Q1 and Q2 ranking in the SCIMAGO Journal and Country Rank (SJR), a book, and a non-Q ranked article. Thus, in total, the results were produced from 2 types of documents: 'article' (n=35) and 'book' (N=1).

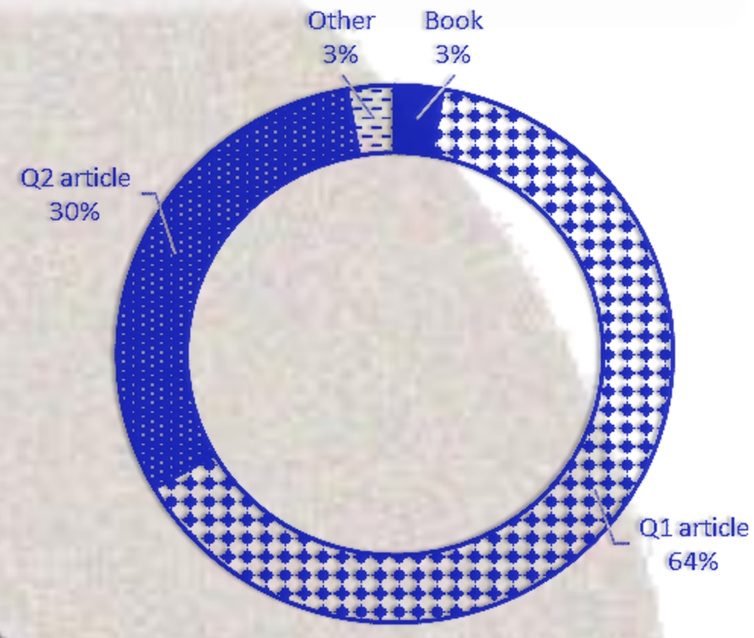

Figure 2. Types of relevant literatures

Figure 3. Traditional (invasive) and eDNA (non-invasive) methods' outcomes

Results and discussions

The most common source of information in aquatic ecosystems to analyse fish species is sampling with fishing nets and electrofishing (EF) methods. But as technology has advanced, non-invasive, rapid, reliable, high-sensitivity eDNA technologies appeared. Two methods are widely used: DNA metabarcoding (which detects all the species) and PCR techniques (confirm the presence of single species). It was shown in the studies, that with traditional methods they sometimes could detect species that were not with the eDNA barcoding (e.g. *S. glanis*) and vice versa. So, with the help of eDNA, we can observe a higher species diversity. But the literature showed that surveys based on eDNA still need to be optimized in terms of species (e.g. *S. glanis* - metabarcoding*)*, sample types, and sampling conditions to achieve the highest overall detection rate. The eDNA-based technologies can be used for accurate and early detection of the presence and spread of invasive species, such as *S. glanis*, for monitoring the biodiversity of fresh, brackish and saline waters, and for monitoring the effects of artificial factors on the ecosystem, as well as for monitoring the diversity of species in standing and flowing water bodies.

Conclusions

The eDNA metabarcoding did not always detect European catfish (or other species), when the traditional methods were able to confirm its presence. To overcome this problem, the use of a species-specific PCR approach or a combination of traditional EF and net techniques along with metabarcoding may be a solution. From the present poster, it can be observed that although the application of eDNA-based methods is recognised as efficient, they are not yet well designed and widespread for the case of *S. glanis* monitoring.

Source: Cucherousset, J., Boulêtreau, S., Azémar, F., Compin, A., Guillaume, M., and Santoul, F., "Freshwater killer whales": beaching behavior of an alien fish to hunt land birds, PloS One, 2012, 7, e50840