



Conference Abstract

# Application of environmental DNA for monitoring and management of aquatic biological invasions: Emerging trends and advancements towards best practice

Emily Y Chen <sup>‡</sup>

<sup>‡</sup> Marine and Freshwater Institute, Galway, Ireland

Corresponding author: Emily Y Chen ([emily.chen@imbrsea.eu](mailto:emily.chen@imbrsea.eu))

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## Abstract

### Introduction

Aquatic Invasive Species (AIS) are a growing concern for global biodiversity as humans continue to accelerate the transport of non-indigenous species beyond their natural range. These species may possess traits that allow them to thrive in new environmental conditions such as non-selective feeding and high reproductive output, causing ecological harm through competition with native species for limited local resources. Consequently, environmental DNA (eDNA) has come to the forefront of AIS management in recent years as a promising method to detect or monitor invasive species using rapid and non-invasive sampling to complement traditional surveying. As eDNA's potential is explored and beginning to be adopted for a variety of applications around the world, it is increasingly important to synthesize the trends in field and laboratory protocols from different working groups to establish guidelines that will allow greater comparability between studies and improve experimental design.

### Methodology and Results

This meta-analytic study collated and reviewed information from previously published eDNA studies that targeted AIS in freshwater and marine environments to recognize current patterns in sampling techniques, laboratory protocols, and potential geographic or taxonomic biases. A total of 492 records from 192 full-text articles were used in the analysis, composed of 408 species-specific and 84 metabarcoding records. With regards to sampling procedures, many studies were not explicit enough for true replicability, lacking critical information such as the volume of filtered water and details of storage conditions. There was no observable trend for eDNA extraction methods in either species-specific or metabarcoding approaches, with choice of extraction method being mostly arbitrary among laboratories as well as influenced by the recent emergence of dedicated commercial kits .

## **Discussion**

This analysis revealed a wide variety of choices for collecting and processing eDNA samples, so it is recommended that there should be some sort of standardized workflow diagram or decision tree for every stage of the experimental design in order for researchers to determine what approaches best meet their research objectives. There is also a clear need for improving metadata reporting guidelines; although the relevance of some criteria depends on the goals and limitations of specific projects, there should be a standardized minimum set of parameters to be reported for each eDNA study, from environmental variables to decontamination practices to PCR conditions. This will increase consistency and transparency through all stages of eDNA research, which is key to collectively improving methodologies and moving forward in this field.

## **Keywords**

environmental DNA, meta-analysis, alien species, biological invasions, aquatic monitoring

## **Presenting author**

Emily Yi-Shyuan Chen

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