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Conference Abstract

eDNA monitoring of invasive Marbled crayfish and impact assessment on native amphibians

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Abstract

Invasive species are a major driver of global biodiversity loss, particularly in freshwater ecosystems. The marbled crayfish (*Procambarus virginalis*), a parthenogenetic invader with exceptional capacity for rapid spread, poses an increasing threat to amphibian communities across Europe. Here we present the implementation of environmental DNA (eDNA)-based monitoring to assess the distribution, ecology, and ecological impacts of this species on native amphibian communities. We developed and validated species-specific digital droplet PCR (ddPCR) assays for sensitive detection and absolute quantification of marbled crayfish and several native amphibians of conservation concern. Mesocosm experiments and field validations demonstrated that ddPCR enables highly sensitive detection and reliable estimation of population size from eDNA samples. Next, we conducted a four-year monitoring program across a large number of ponds and fens in the Hatertse Vennen (the Netherlands), a nature reserve and biodiversity hotspot supporting protected species such as the great crested newt (*Triturus cristatus*), moor frog (*Rana arvalis*), and spadefoot toad (*Pelobates fuscus*). This study revealed that marbled crayfish is far more widespread and abundant than previously assumed, with ongoing annual expansion. Concurrent amphibian eDNA monitoring indicated strong negative effects associated with crayfish presence, including substantial population declines at invaded sites. These findings are now informing targeted management actions, including

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eradication efforts and the implementation of dispersal barriers designed to limit crayfish spread while maintaining amphibian connectivity. Our study highlights ddPCR-based eDNA monitoring as a powerful tool for invasive species detection, population assessment, and impact evaluation. More broadly, this approach provides a scalable framework for conserving amphibian biodiversity in vulnerable freshwater ecosystems.

Keywords

Amphibian conservation, environmental DNA (eDNA), invasive species management, *Procambarus virginalis*

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Conflicts of interest

The authors have declared that no competing interests exist.