eDNA insight: Invasive species

Early detection of invasive species with eDNA

Invasive species pose a huge threat to Australia's biodiversity and economy. Unfortunately, once invasive species have become established, they can be difficult or even impossible to eradicate. An infamous example is the cane toad, which is having devastating impacts on native mammals, reptiles, amphibians and fish. To prevent the spread of cane toads and other invasive species, we need to detect them as early as possible, when eradication is more feasible.

Environmental DNA (eDNA) is a powerful new tool for detecting species, presenting an important opportunity for Australia's biosecurity and invasive species management efforts. Every species leaves fragments of its DNA in the environment. By extracting DNA from environmental samples, such as water samples, we can find out whether a species has been there without having to capture or directly observe the species. Importantly, DNA breaks down in water within days or weeks[1], meaning that any species detected was present recently.

Why use eDNA?

'Invasive species usually don't arrive in their thousands – they start out at low abundance,' says Dr Reid Tingley, a researcher at Monash University, 'And that's when you need to act.'

In 2016 and 2017, Dr Tingley and his colleagues trialled using eDNA to detect cane toads in New South Wales and Queensland. They found that just two water samples were sufficient for >95% probability of detecting cane toads at a site, if they were present[2]. The researchers also correctly detected cane toads at a new site, where they had not yet been detected using other methods.

'You can get higher sensitivity for less effort,' says Dr Tingley, 'You also have high confidence that if you aren't detecting a species, it hasn't arrived.'

The research highlights the key advantages of using eDNA: it is effective at detecting species at low abundance, cost-efficient, easily standardised, logistically simple, and quick. Taking water samples is also relatively safe; since no animals need to be captured or handled, there are fewer risks for the person collecting data, local animals, and the environment.

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How is eDNA being used?

eDNA is enabling ecologists, land/waterway managers and field officers to establish large-scale, standardised surveillance programs for both native and invasive species. While there is some information that eDNA cannot yet provide, including the sex, health or life stage of an animal, eDNA gives critical, basic information about where species are with high sensitivity[3].

In Australia, eDNA has helped ensure the continued absence of cane toads on offshore islands, which are important strongholds for many native species[2]. eDNA has also been used to monitor the invasion front of Mozambique tilapia, an invasive fish, in the Fitzroy Basin[4]. Members of the Fitzroy Basin Association were empowered to collect eDNA water samples themselves, helping to reduce external costs. As another example, in the United States, fisheries are protecting a multi-million dollar fishing industry by using eDNA to detect incursions of Asian carp, which are otherwise difficult to detect at low densities[5].

Generally, eDNA samples need to be analysed in a laboratory. However, technological advances are starting to allow eDNA to be analysed in the field. This will provide rapid results on-site that managers can immediately act upon. Even today, the simplicity of collecting water samples — compared with having to source expertise and permits for trapping programs — is hugely beneficial for anyone needing to quickly know whether a threat has arrived somewhere new.

"eDNA allows you to test thousands of sites for invasive species, within a single field season," says Dr Tingley, "It's a powerful surveillance tool."

Contact us

Interested in using eDNA for early detection or ongoing monitoring of invasive species like cane toads? Contact EnviroDNA via email or visit our website.

Email: **info@envirodna.com**
Web: **envirodna.com**

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