ENVIRONMENTAL DNA (eDNA)

INSTITUTE FOR APPLIED ECOLOGY, UNIVERSITY OF CANBERRA

UNIVERSITY OF CANBERRA | INSTITUTE FOR APPLIED ECOLOGY

Photo credit: Charles Davis

Our eDNA team use specialist genetic tools to detect natives and invaders.

Traditional methods of species monitoring can be expensive and challenging. However researchers at the Institute for Applied Ecology (IAE) have developed sensitive and cost-effective methods to confirm if a species is present in an area. This method uses traces of DNA that species leave behind in the soil, sediment, marine or freshwater and is called Environmental DNA (eDNA). The applications include detection of invaders or rare species of conservation concern. Our team are experts in sample collection, processing and analysis.

WHAT WE DO

- Develop eDNA assays for the detection of a single target species and validate it both in the laboratory and the field
- Multi-species detection using eDNA meta-barcoding that enables an inventory of biodiversity present in a water sample
- Detection of terrestrial species from eDNA samples derived from water sources, such as feral pigs, horses, wild dogs.

"eDNA: Making the invisible visible"

OUR FACILITIES

- eDNA sampling equipment and specialist water filtering facilities
- Trace DNA laboratory for handling eDNA samples
- Separate pre and post PCR facilities for QA/QC protocols
- Sample preparation in accredited PC2 laboratories
- Reference DNA and tissue databases
- Animal holding facility, including freshwater and terrestrial.

OUR PARTNERS

The University of Canberra host the Centre for Invasive Species Solutions and partner with them in the development of technologies to support eDNA advancements. We are also a key collaborator with the CSIRO on the Future Science Platform 'Environomics'.

CONTACT US

Associate Professor Dianne Gleeson

T (02) 6201 2237
E Dianne.Gleeson@canberra.edu.au

Dr Elise Furlan

T (02) 6201 5528
E Elise.Furlan@canberra.edu.au

PROJECT HIGHLIGHTS

FOCUSSING ON SOLUTIONS

Photo credit: Elise Furlan

DEVELOPMENT OF A DETECTION PROBABILITY FRAMEWORK

Environmental DNA (eDNA) is increasingly used as a survey tool to infer species distributions. eDNA has advantages over traditional detection tools as it is non-invasive, samples are often easy to collect, and it reduces the need for taxonomic expertise. The technique does, however, require careful evaluation of sensitivity.

Researchers at the IAE have developed a framework to estimate the sensitivity of both the field and laboratory components of this method, and combine them to estimate overall sensitivity. This framework has been applied to species-specific eDNA surveys to estimate the sensitivity, or probability of detection, for three invasive aquatic species in Australia; redfin perch (*Perca fluviatilis*), carp (*Cyprinus carpio*), and Oriental weatherloach (*Misgurnus anguillicaudatus*).

The IAE developed framework enables researchers to quantify overall sensitivity of a particular eDNA survey method, and to optimise sampling regimes. Thisultimately provides the most robust data to inform management actions.

Furlan, E., Gleeson, D. M., Hardy, C. M., & Duncan, R. P. (2016). A framework for estimating the sensitivity of eDNA surveys. *Molecular Ecology Resources*. 10.1111/1755-0998.12483.

Photo credit: Jonas Bylemans

INVASIVE SPECIES MANAGEMENT

Once an invasive species becomes established, containment can provide an effective management option. This only works, however, if distribution limits are accurately detected.

Improved sensitivity of eDNA-based surveys makes this method particularly useful to determine outer distribution limits. Researchers at the IAE compared conventional monitoring methods and eDNA-based monitoring to determine the spread of the invasive redfin perch (*Perca fluviatilis*) in an intermittent river system. This voracious predatory fish is responsible for the continued decline of several threatened and vulnerable species in Australia, and in this system was a potential threat to the native and threatened Southern pygmy perch (*Nannoperca australis*). They demonstrated that eDNA was more sensitive than traditional methods and the combination of conventional and eDNA-based monitoring vastly improved redfin perch distribution data resulting in the optimal location for the construction of an exclusion barrier. This is one of the first eDNA studies to demonstrate a clear management outcome.

Bylemans J., Fulan E.M., Pearce L., Daly T., Gleeson D.M. (2016) Improving the containment of a freshwater invader using environmental DNA (eDNA) based monitoring. *Biological Invasions* 18 (10) DOI: 10.1007/s10530-016-1203-5

Photo credit: Ben Broadhurst

DETECTION OF SPAWNING IN THREATENED SPECIES

The application of eDNA for detecting reproductive activity in aquatic organisms has the potential to increase our knowledge of reproductive biology in elusive species. It also helps evaluate management actions aimed at increasing the reproductive output of endangered populations.

IAE researchers have detected spawning of the threatened Macquarie perch by comparing the abundance of different types of eDNA produced during the spawning period. Previously, the detection of spawning in this species has been carried out using labour intensive egg-netting methods that have the potential to miss these sporadic events. This eDNA method can help evaluate whether population declines are caused either by spawning failure or high mortality rates of the early life history stages.

Bylemans J., Furlan E.M., Hardy C.M., McGuffie P., Lintermans M., Gleeson D.M. (2016) An environmental DNA (eDNA) based method for monitoring spawning activity: a case study using the endangered Macquarie perch (*Macquaria australasica*). *Methods in Ecology and Evolution* DOI: 10.1111/2041-210X.12709

WHERE YOU CAN **FIND US**

IN PERSON Building 3, Level C, Room 1
POST Institute for Applied Ecology, University of Canberra, ACT, 2601
TELEPHONE +61 (2) 6201 2795 **EMAIL** iaeadmin@canberra.edu.au
ONLINE www.canberra.edu.au/iae **www.appliedecology.edu.au**

UNIVERSITY OF CANBERRA | INSTITUTE FOR APPLIED ECOLOGY