University of Southern Queensland

Artificial livestock waterbodies provide a valuable source of environmental DNA for threatened ground-nesting birds

Environmental DNA (under review)

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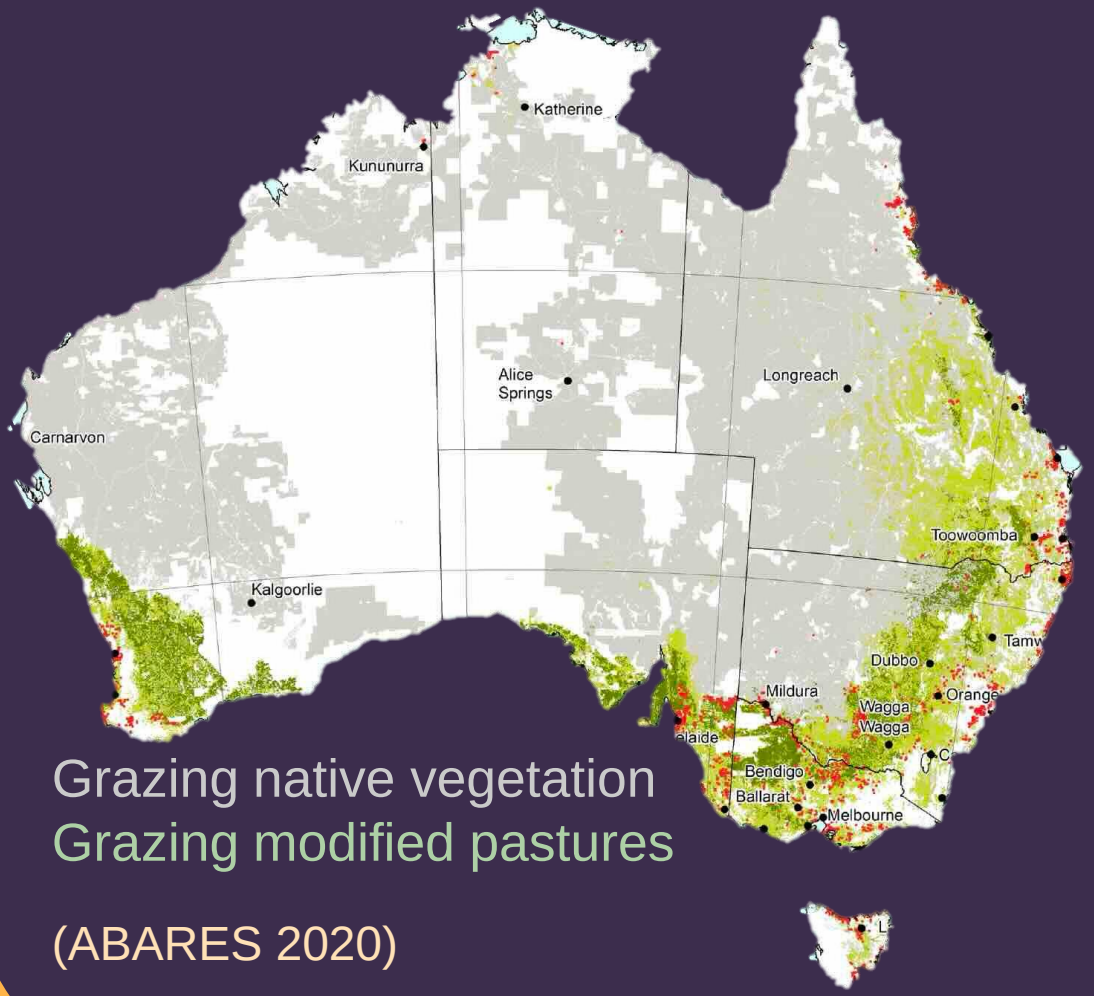
Livestock waterbodies as a source of eDNA?



Grazing native vegetation
Grazing modified pastures

(ABARES 2020)

Grazing land = 42% of Australia (3.3 M km^2) and 36% of New Zealand (FAO, 2024).

Estimate of one artificial livestock waterbody every ~5 km (e.g., dam, trough) in grazing lands (James 1999), or >645K in Australia.

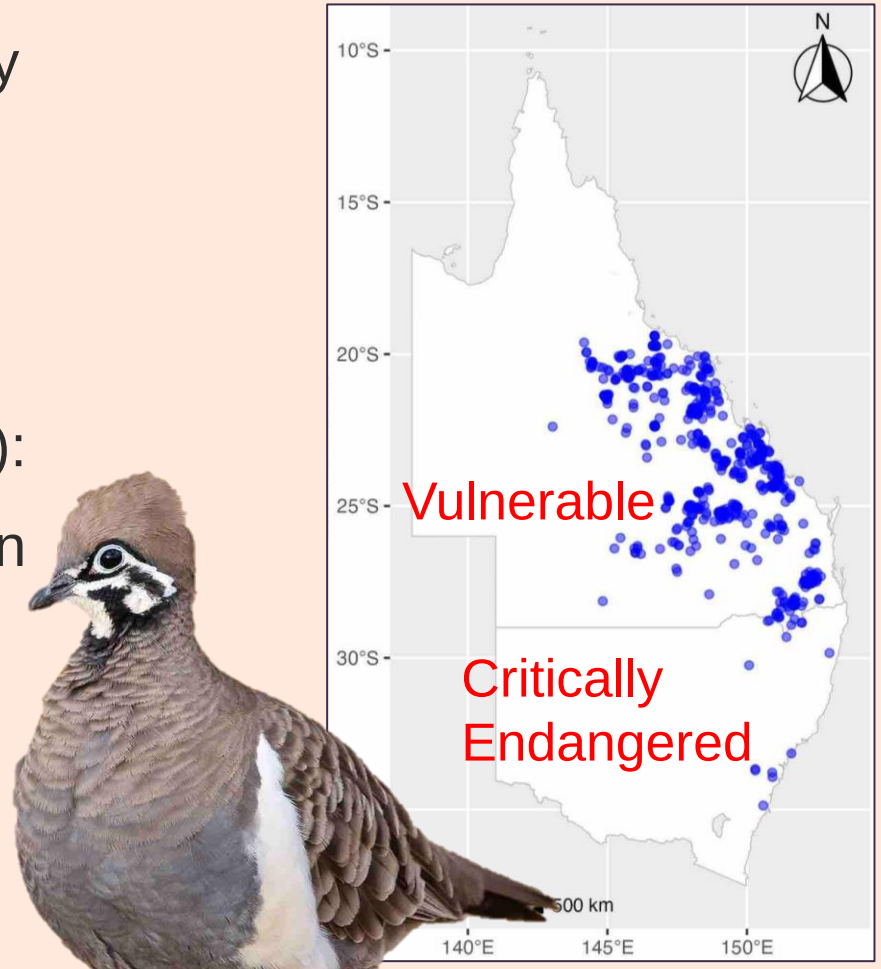
Can we use waterbodies to monitor terrestrial birds?

Why monitor (ground-nesting) birds using eDNA?

- Limited studies on terrestrial species, especially birds (first by Ushio et al. 2018).
- Ground-nesting birds, among most threatened avian group worldwide (Reif et al. 2023; McMahon et al. 2024)

One example, squatter pigeon (*Geophaps scripta*):

- Granivorous, ground-nester, endemic to eastern Australia.
- Common northern; and Vulnerable southern subspecies (*G. scripta scripta*) = Matter of National Environment Significance (Franklin 1999; Ward et al. 2021).



Southern squatter pigeon (Geophaps scripta scripta) Photo credit: © Ged Tranter

Aims and Experimental Design

1. Develop species-specific qPCR assay to detect the squatter pigeon (University of Canberra)
2. Active (syringe) vs passive filtration at water troughs and farm dams

VS

VS

VS

3. Repeat (2) between early and late dry season in tropical savanna of north Queensland

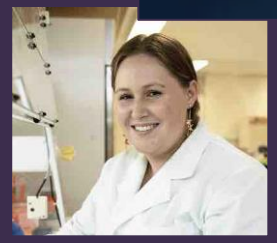
Aim 1: Developing the qPCR assay

The wonderful team! Led by ARC DECRA Fellow Dr. Elise Furlan at the University of Canberra

Dr. Elise Furlan

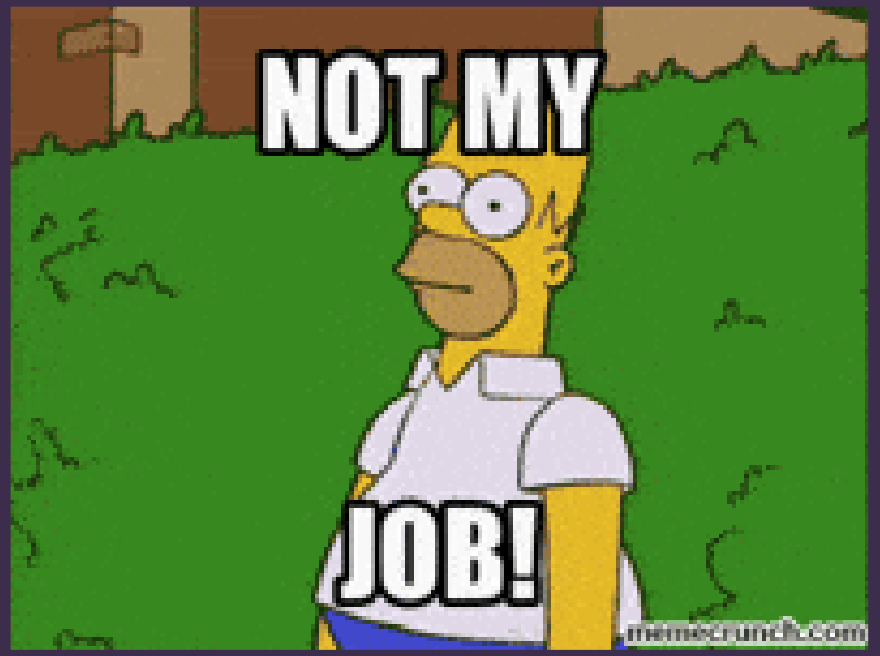
Henriette Theron

EcoDNA



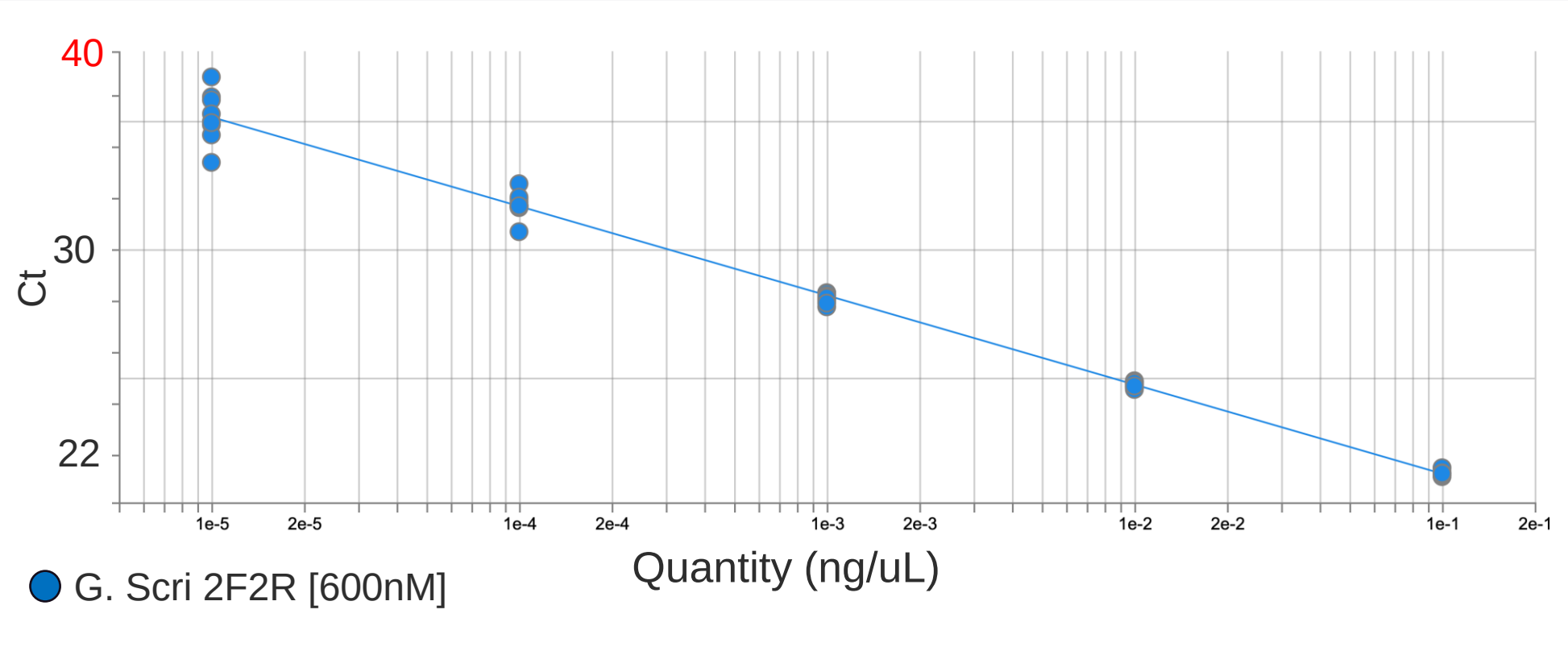
Kymberly Crockett

Jenn Soroka



1: Assay results

Detected DNA concentrations as low as 1 x 10^{-7} ng/uL at 94.1% (R^2 = 0.992)



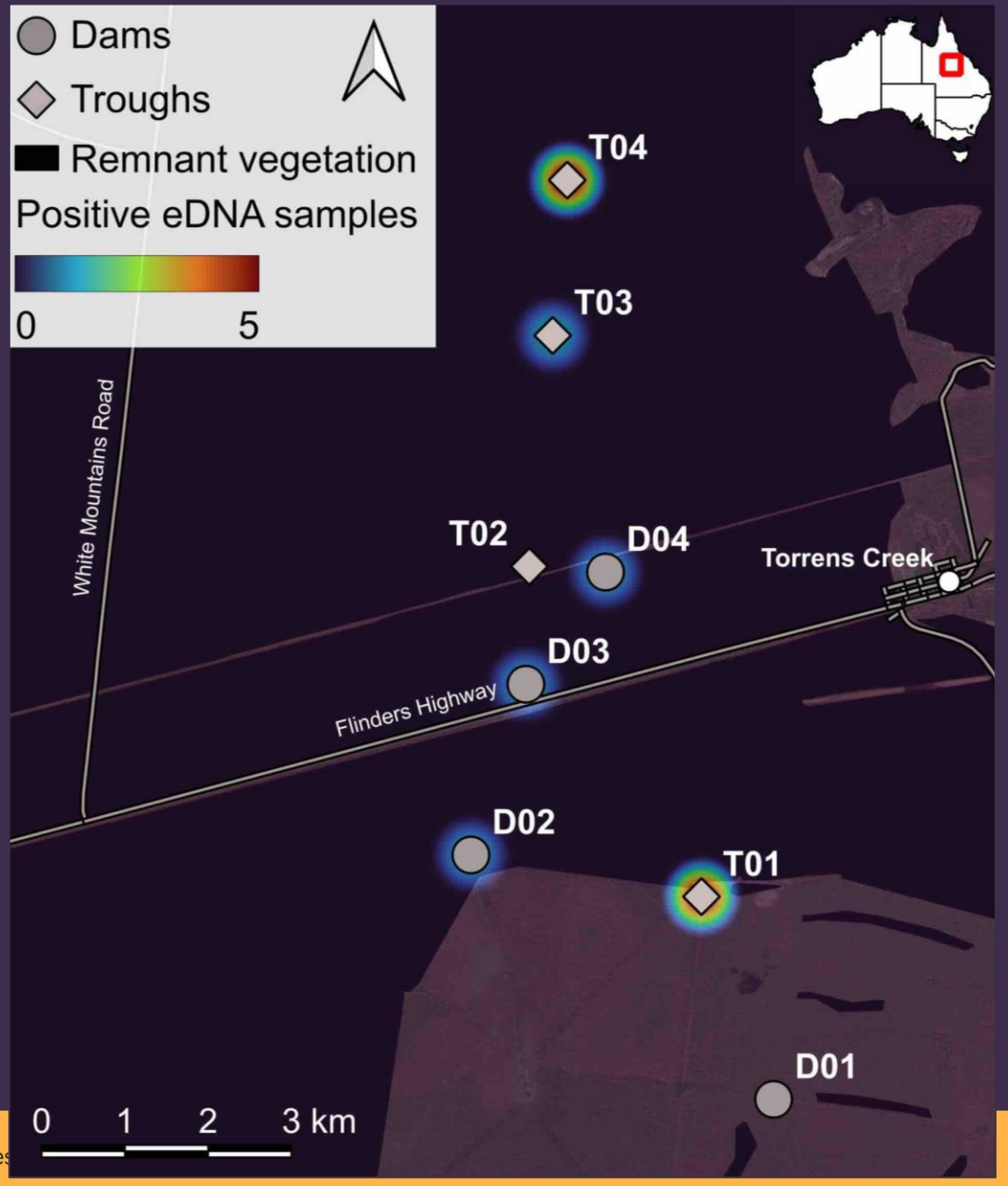
Target DNA (≤40) detected early in PCR process = higher initial concentration of *G. scripta scripta* eDNA sample.

Aim 2: field validation

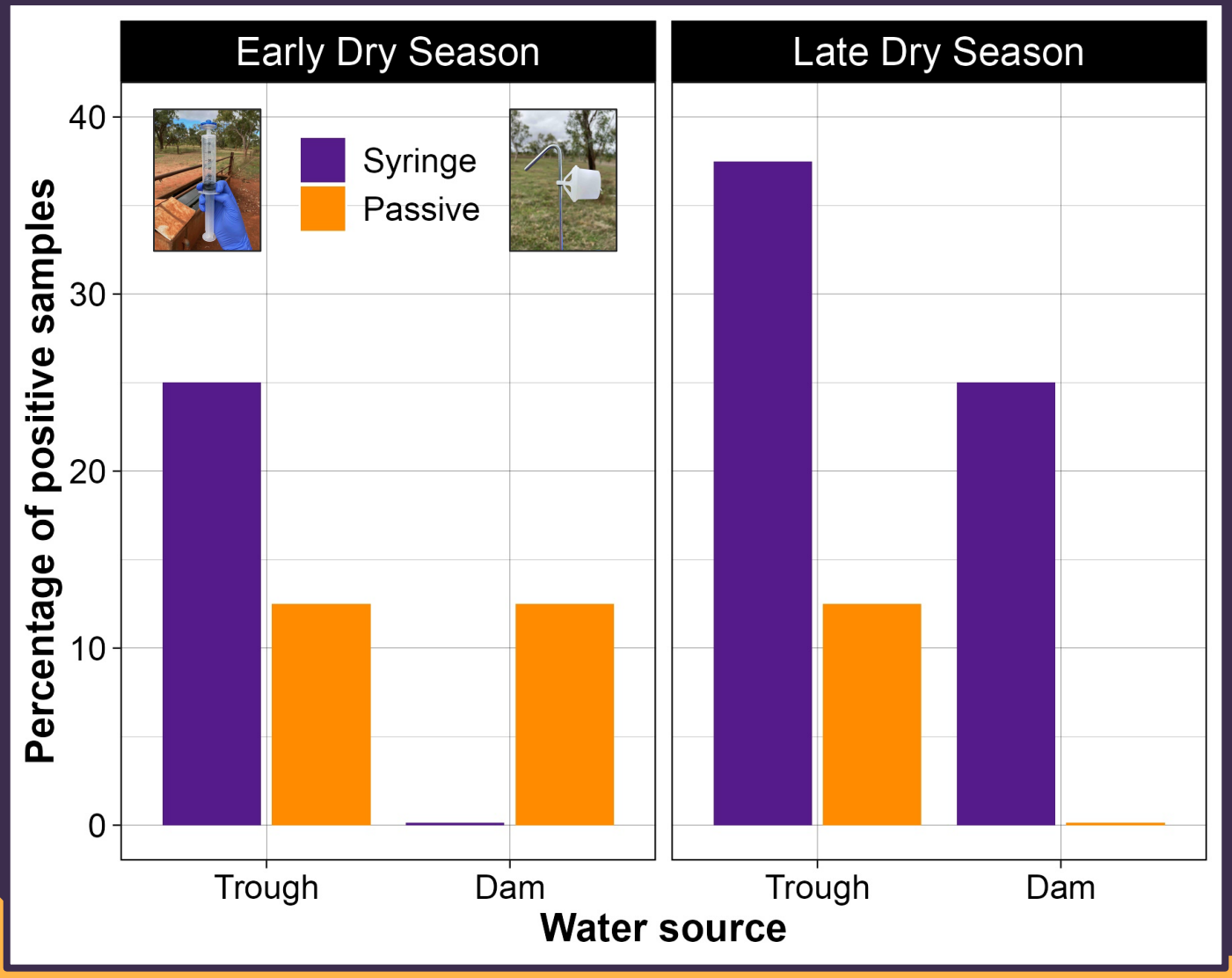
- Semi-arid tropical Eucalypt open woodland.
- Min and max temperature on days of water sampling:

early dry (July) = 13.9 °C and 26.5 °C

late dry (Nov) = 18.4 °C and 41.2 °C



2 and 3: eDNA sampling results



Combined across season

Sampling method:

- Active: 22% at 5 sites
- Passive: 9% at 3 sites.

Waterbody type:

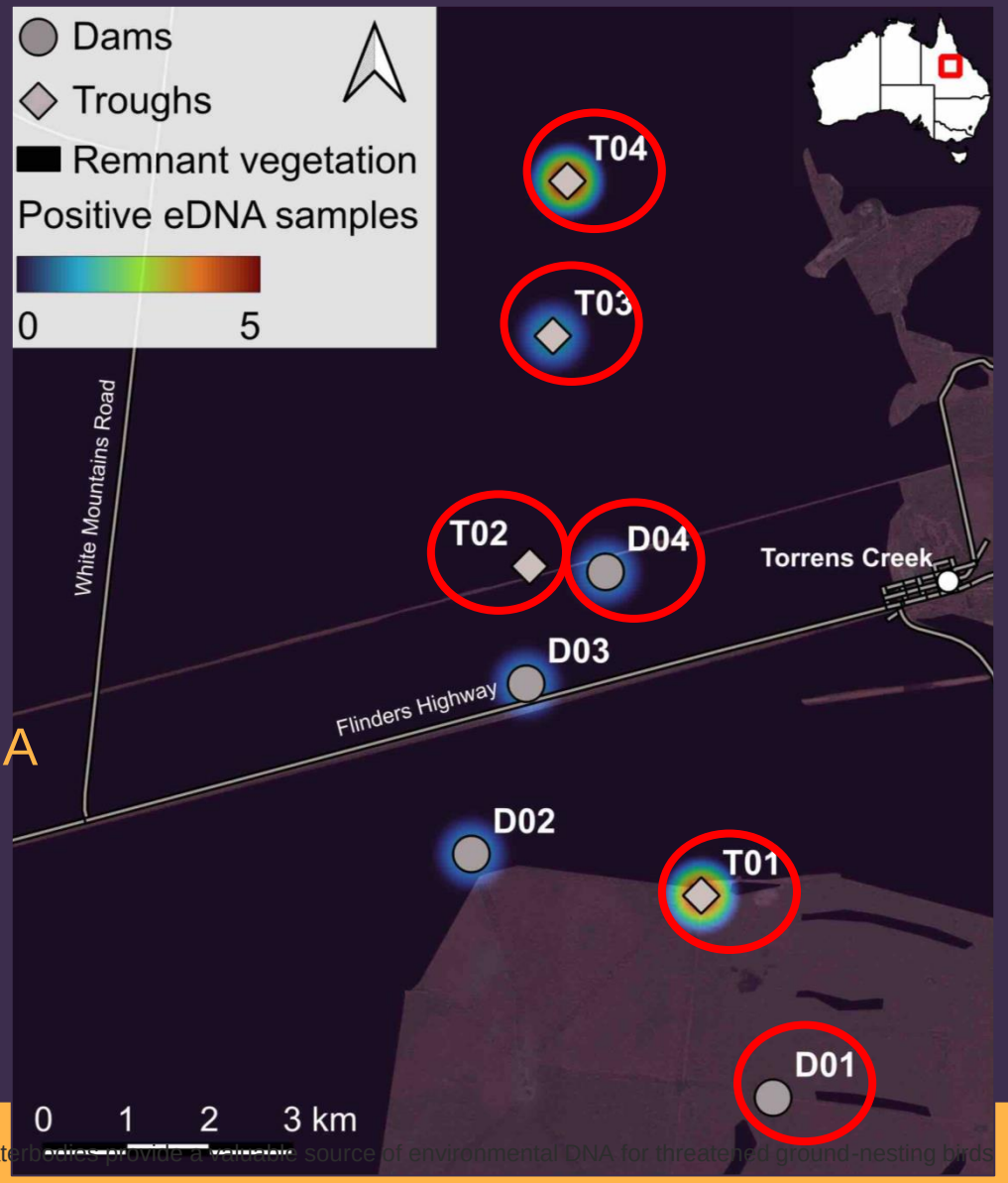
- Trough: 22% at 5 sites
- Dams: 9% at 3 sites

Visual bird counts vs eDNA sampling

vs

Squatter pigeon visual counts matched eDNA site detections but not always exact.

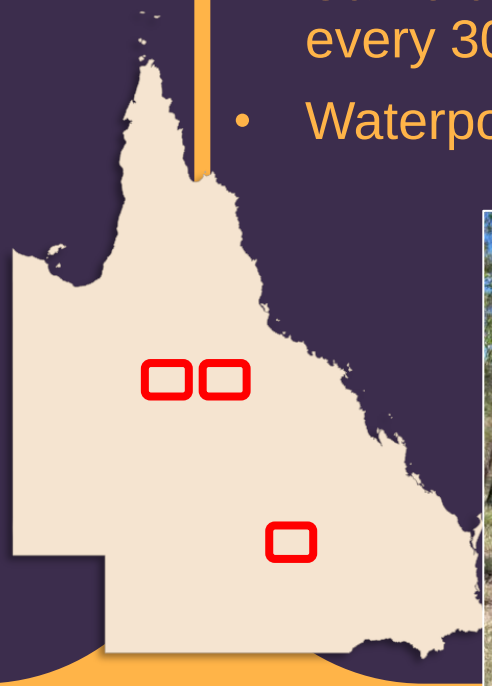
Take home message: complementarity in monitoring (visual + eDNA) methods!

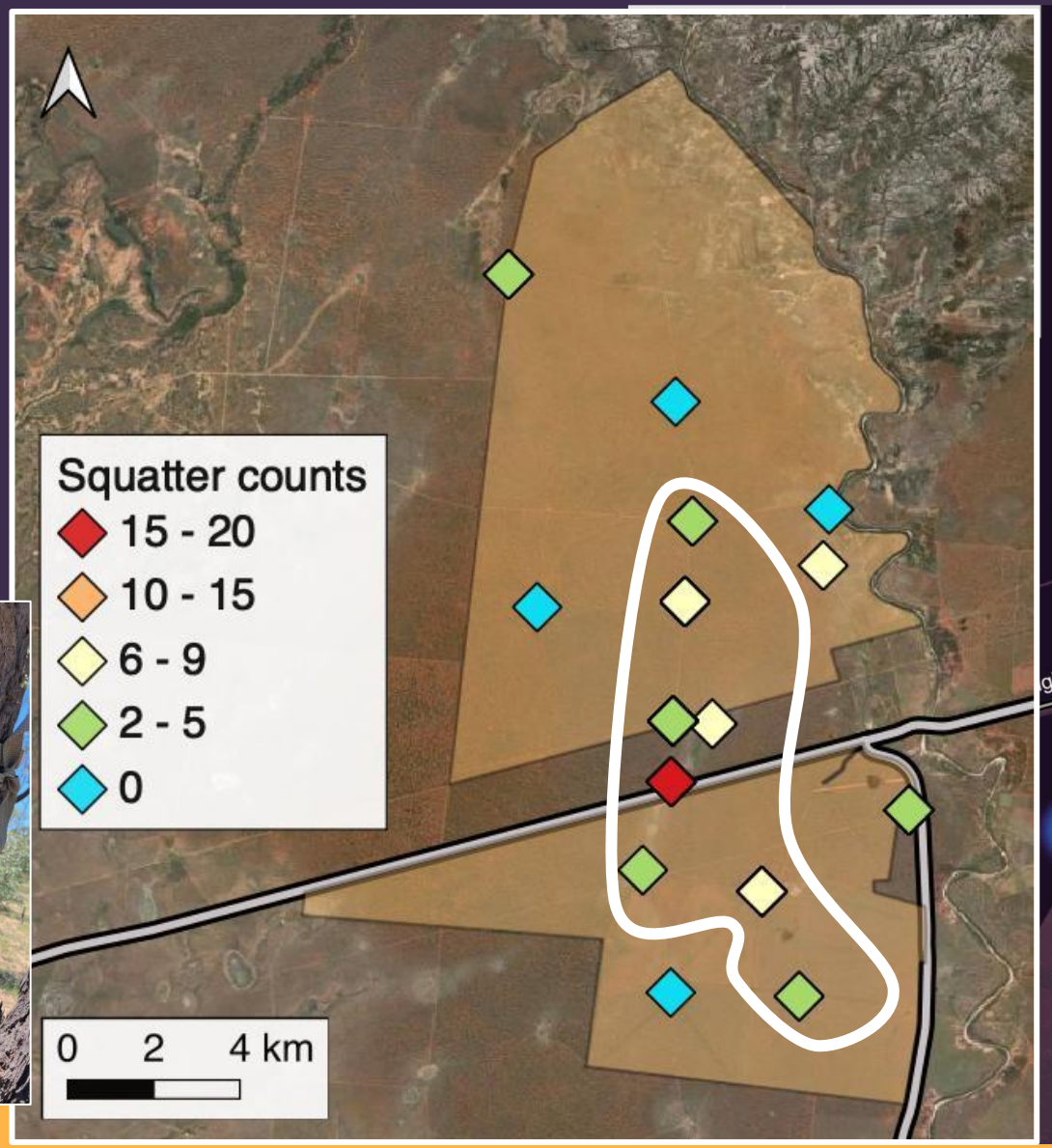


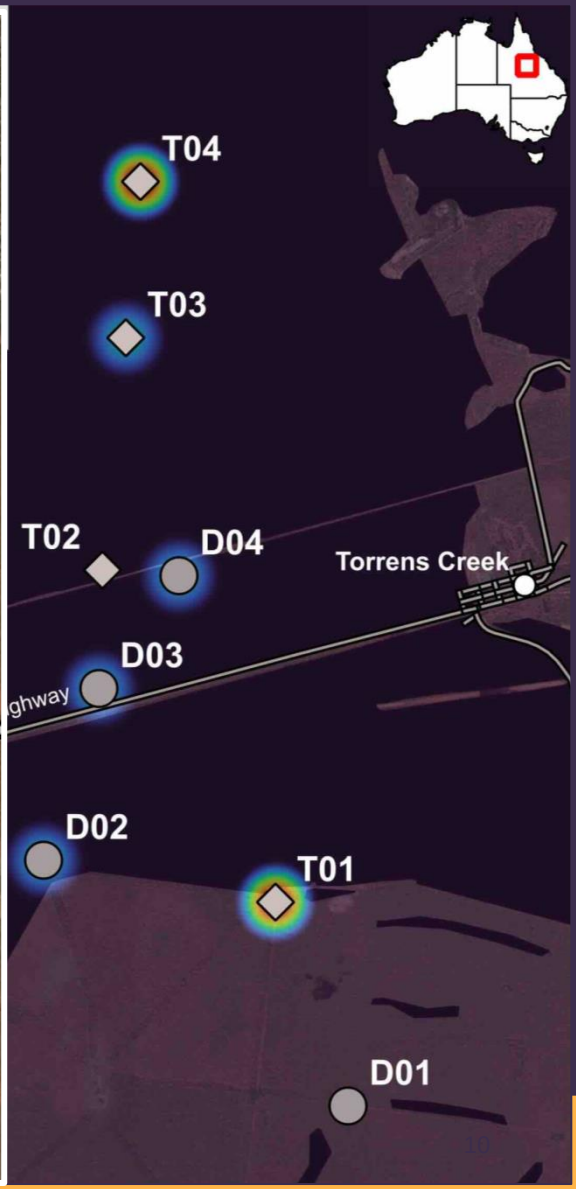
This study complements other work (my PhD!)

Additional research:

- Two years
- Three properties
- 45 camera locations
- Cameras take photo every 30 mins
- Waterpoints







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Conclusion

- We validated the assay (R^2 = 0.992, 94.1%) in the field using both active and passive samplers at multiple dams and troughs (despite *N* = 2 replicates per site!).
- The assay can detect both northern and southern subspecies from other substrates, e.g., air, soil or water.
- Active samplers generally outperformed passive filtration.
- The assay is a significant advancement in the conservation and management for the *G. scripta scripta*.

Future research?

Acknowledgements


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EcoDNA


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