



Manaaki Whenua
Landcare Research

How DNA research can help kiwi survive

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Collaborators:

MWLR – Talia Brav-Cubitt, Julia Allwood, Hester Roberts, Andrew Veale, Kiri Reihana, John Innes

DOC – Hugh Robertson, Rogan Colbourne

Funding:

MBIE CO9X1609: Kiwi Rescue



Kiwi Rescue

“Working with DOC and Kiwis for Kiwi, we will clarify how many kiwi species there are, **develop new DNA-based techniques to estimate kiwi population size from feathers and scats and identify predatory dogs, stoats and ferrets at the individual (not just species) level**”



**MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT**
HĪKINA WHAKATUTUKI





Current kiwi population trends

- Unmanaged populations of kiwi are estimated to be declining at a rate of 2% per annum.
- 24% of the estimated 68 000 remaining kiwi are under some management, the remaining 76% are unmanaged.

Taxa	2015 population estimate	% under active management	Actual number of kiwi actively managed	2030 population estimate	Predicted % increase over 15 years
Little spotted	1,800	100%	1,800	2,867	3.2%
Great spotted	14,800	12.6%	1,858	12,428	-1.6% decline
Northland brown	8,200	49.7%	4,075	12,325	2.8%
Coromandel brown	1,700	74.7%	1,270	3,411	4.8%
Eastern brown	7,150	21%	1,500	7,281	1.0%
Western brown	7,500	43.7%	3,280	9,064	1.3%
Rowi	500	100%	500	891	3.9%
Haast tokoeka	400	80%	320	738	4.2%
Fiordland tokoeka	12,500	8.8%	1,100	10,722	-1.0% decline
Rakiura (Stewart Island) tokoeka	13,000	1.9%	250	9,962	-1.8% decline



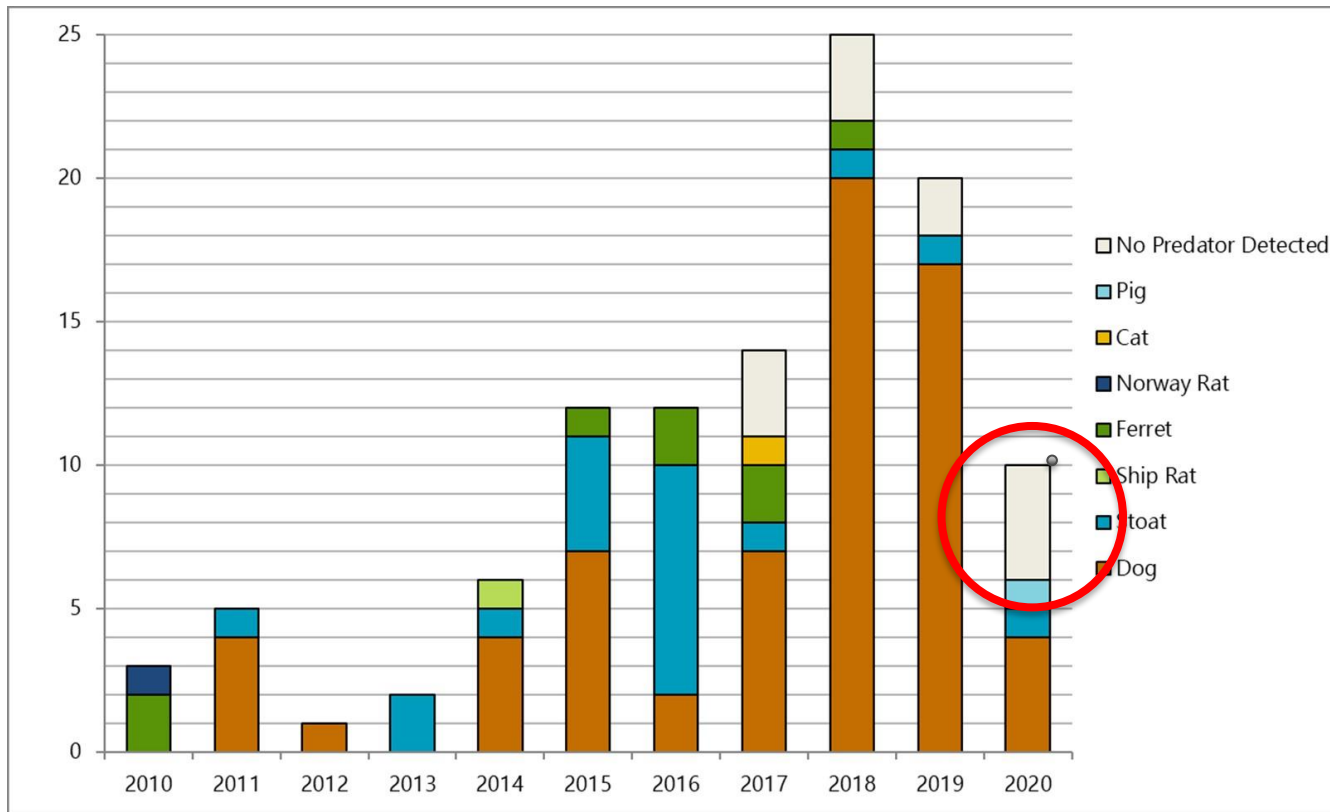
EcoGene: Business Unit

- Established 2008
- DNA-based diagnostics for wildlife applications
- Approx. 100-150 projects per year
- Clients include DOC, MPI, Universities, International groups, District councils





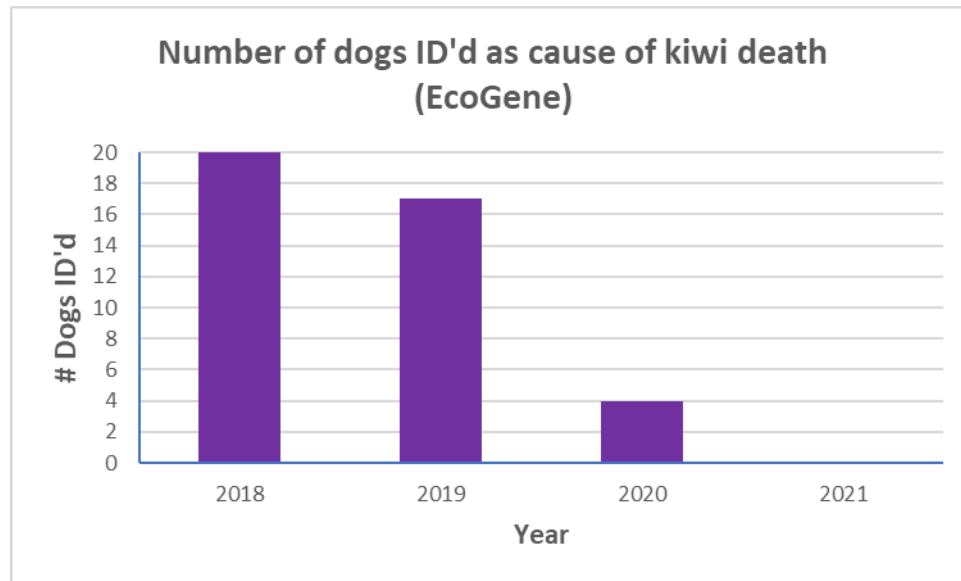
Kiwi Predators identified through EcoGene



DogFiler



- A forensic tool for dog attacks and dog fighting in the USA
- Kiwi Rescue introduced tool to USE in NZ
- Civil Prosecutions – Dog Control Act
- 2x Criminal Cases tried under the Wildlife Act in 2020





Individual stoats and ferrets as predators

Ferretplex

- IDs individual ferrets
- Developed for ferrets as TB-vector
- Adapted for use in kiwi forensic setting

Individual A

...GGCTATCGAGCCAATATATATATGCT..
...CCGATAGCTCGGTTATATATATACGA...

Individual B

...GGCTATCGAGCCAATATGCT..
...CCGATAGCTCGGTTATACGA...

Microsatellite

Stoats

- Can ID individual stoats from good quality DNA – microsatellites
- 50,000+ variable sites in the stoat genome – 94 stoats, 15 populations
- Developed a 200 SNP panel
- Can identify
 - individual
 - sex
 - lineage
 - ancestry



Individual

...AGTT
...TCAA

Individual

...AGTT
...TCAA

Fun Fact:

the stoat genome is
~2.4 billion DNA
blocks long!

In between the
human (~6.4 b) and
the kiwi (~1.5 b)
genomes in size.

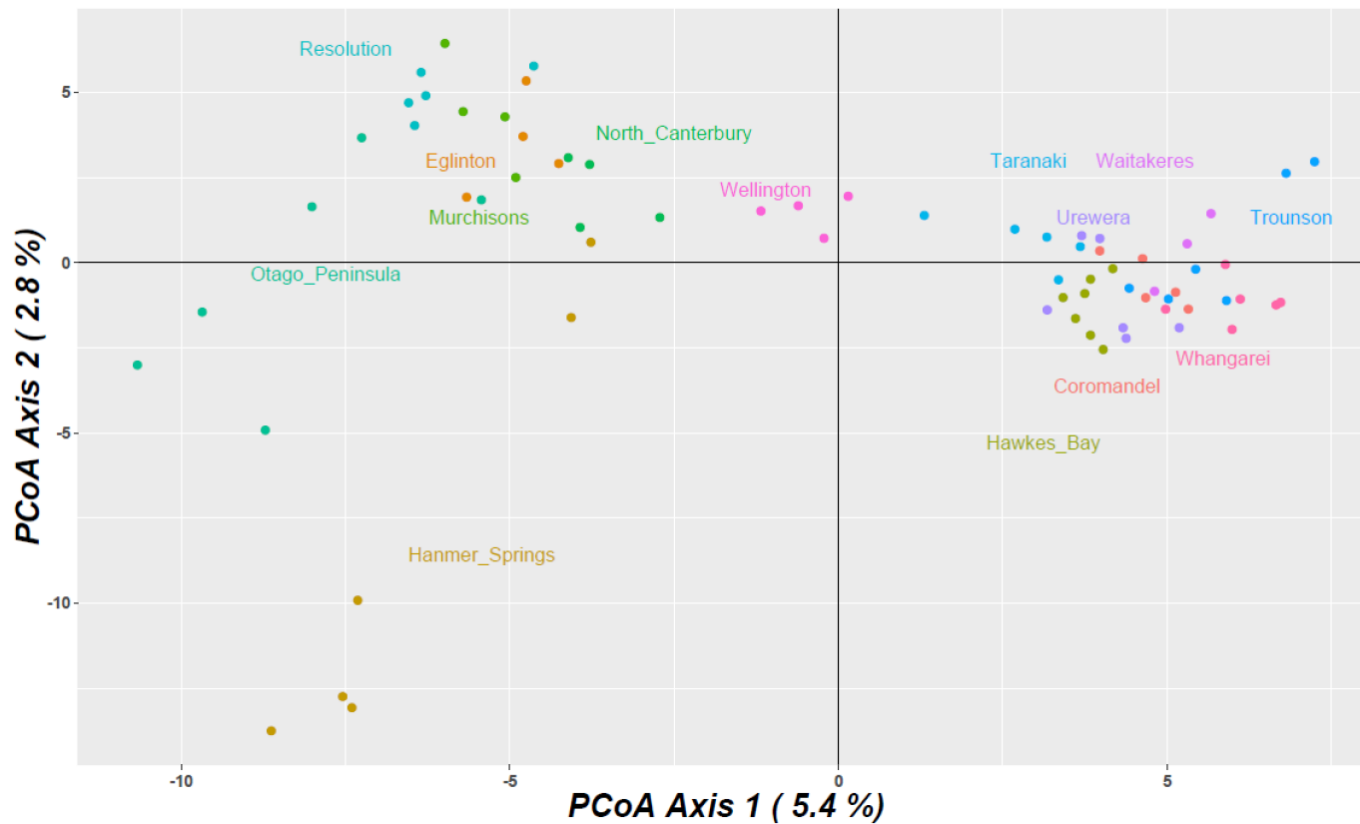
CAAGCCT
GTTTCGGA

CAAGCCT
GTTTCGGA

SNP



National / regional stoat genome



Kiwi DNA in predator faeces



Aim: Identify kiwi DNA in predator faeces

Proof-of-concept: Designed probe-based DNA tool that identifies kiwi DNA in faecal and soil samples down to the 10s of femtograms* (of kiwi material)

Feeding trial:

- Three captive stoats offered kiwi meat (leg, liver, heart) for 48 hrs.
- All three stoats ate leg muscle meat, offal barely touched.

Kiwi DNA identified in faeces of all three stoats for 5+ days

*1 femtogram = 10^{-15} grams



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Validation of a molecular tool to estimate population size

- Can a molecular technique estimate population trajectories in kiwi?
- What is the relationship between census population size and effective population size in kiwi?

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DOI: 10.1002/ece.3.3795

ORIGINAL RESEARCH

WILEY Ecology and Evolution

Extraction of DNA from captive-sourced feces and molted feathers provides a novel method for conservation management of New Zealand kiwi (*Apteryx* spp.)

Ana Ramón-Laca¹ | Daniel J. White^{1,2}  | Jason T. Weir^{3,4} | Hugh A. Robertson⁵



eDNA for population monitoring

Question: Can feathers and scat be collected in the field in sufficient quantity and quality to enable estimation of effective population size?



Yeah



Bro



eDNA for population monitoring



Question: Can feathers and scat be collected in the field in sufficient quantity and quality to enable estimation of effective population size?

- Surveyed Mason's Bay, Pukaha Mt Bruce, Trounson Kauri Park and Rotokare
- Could not find samples in sufficient quantity or quality
- Need trained kiwi dogs to find more feathers/scat. Cost dog-hours vs other surveys

To do: investigate kiwi eDNA in soil using the probe tool developed for scats



Thank you!!

To all those too numerous to mention who collected samples, accompanied us in the field, commiserated with us and celebrated with us!!

