Spotlight on Amphibians

Challenges and opportunities in native frog research and management

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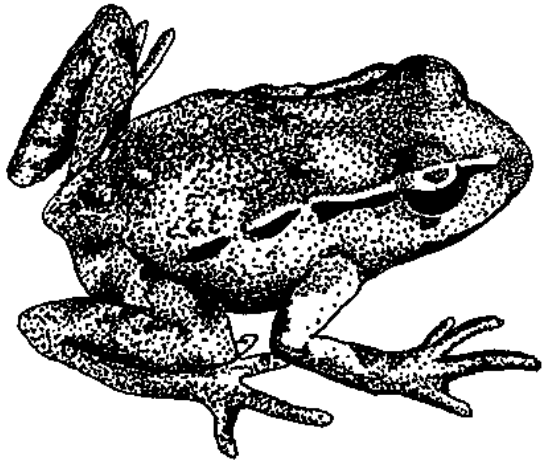
Department of Conservation

Outline

1. Species, Distribution and Ecology
2. Threats and Conservation Management
3. Recent Research
4. Challenges/Next Steps



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2. **Threats and Conservation Management**
3. **Recent Research**
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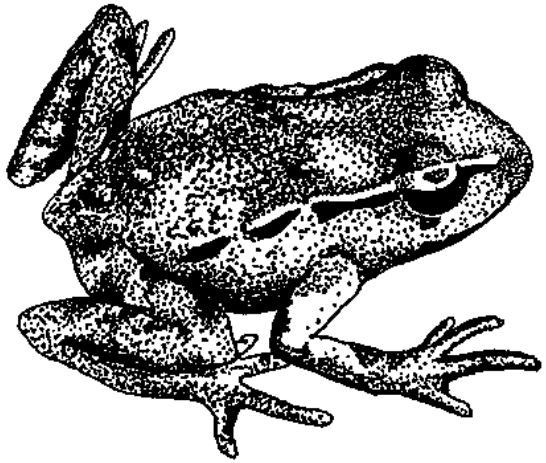

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Four species (*Leiopelma)*

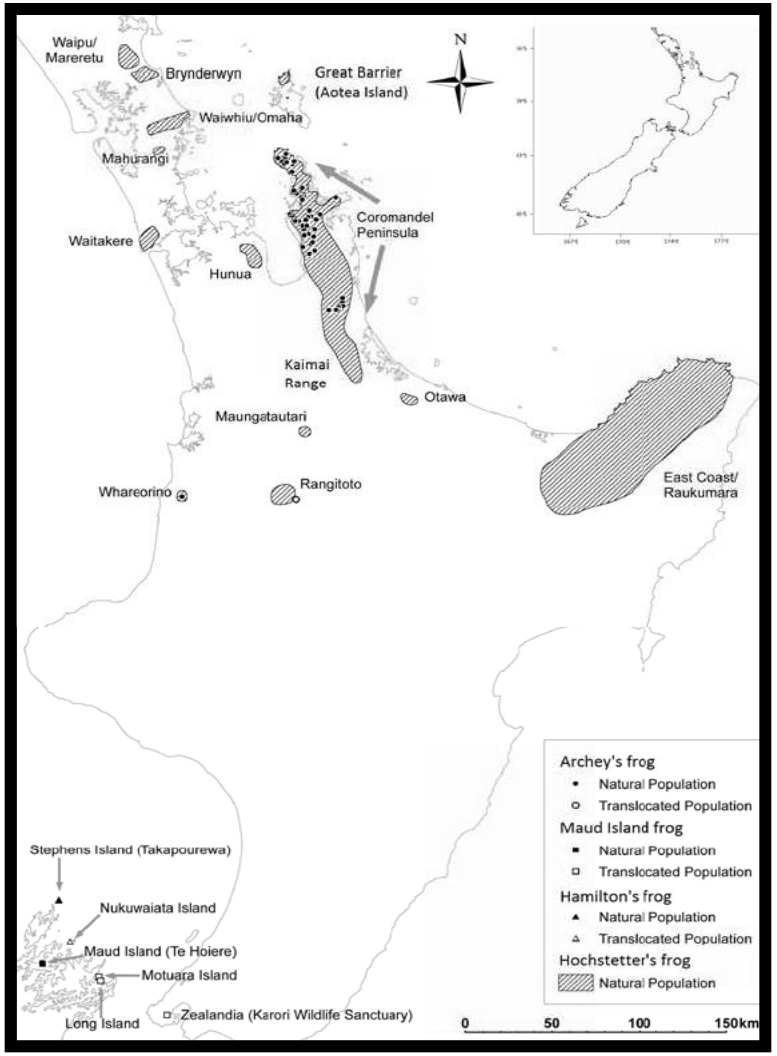
Archey's frog (*L. archeyi)*

Hochstetter's frog (*L. hochstetteri)*

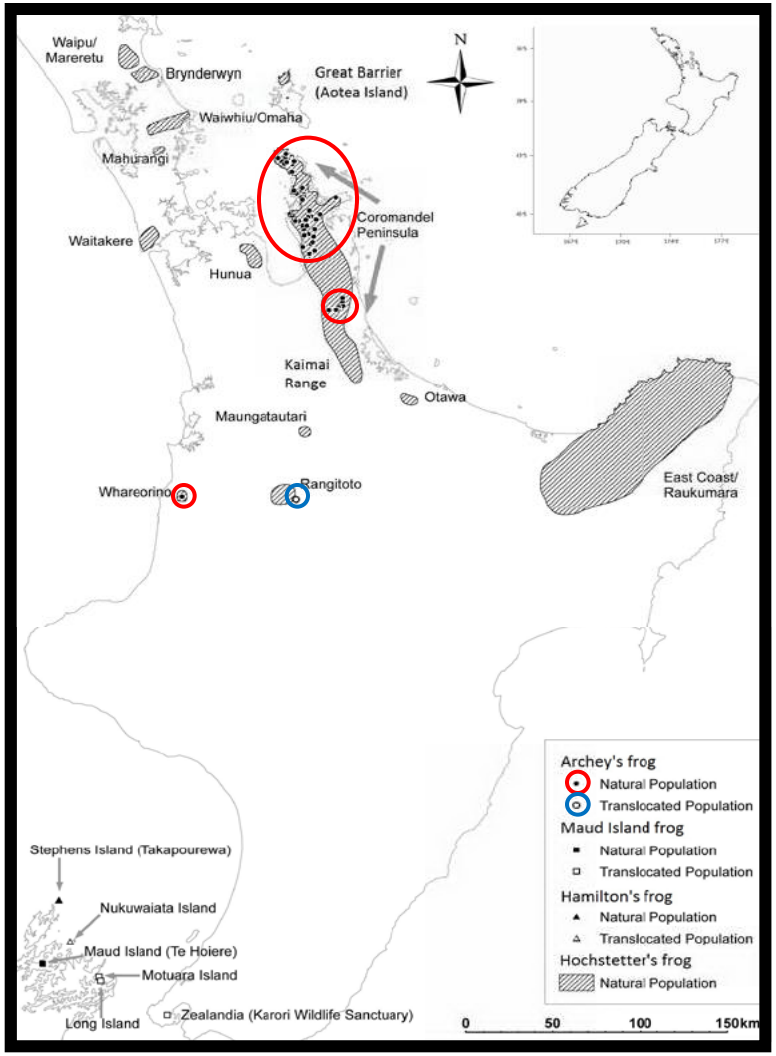
Maud Island frog (*L. pakeka)*

Hamilton's frog (*L. hamiltoni)*

Distribution



Distribution



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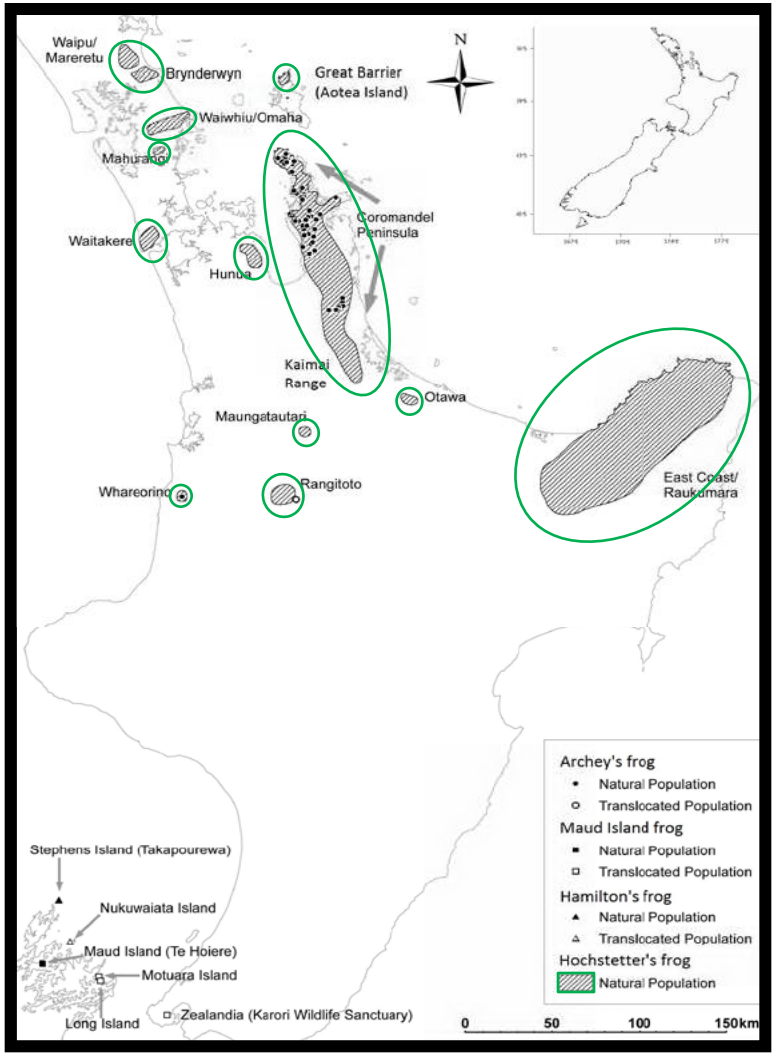

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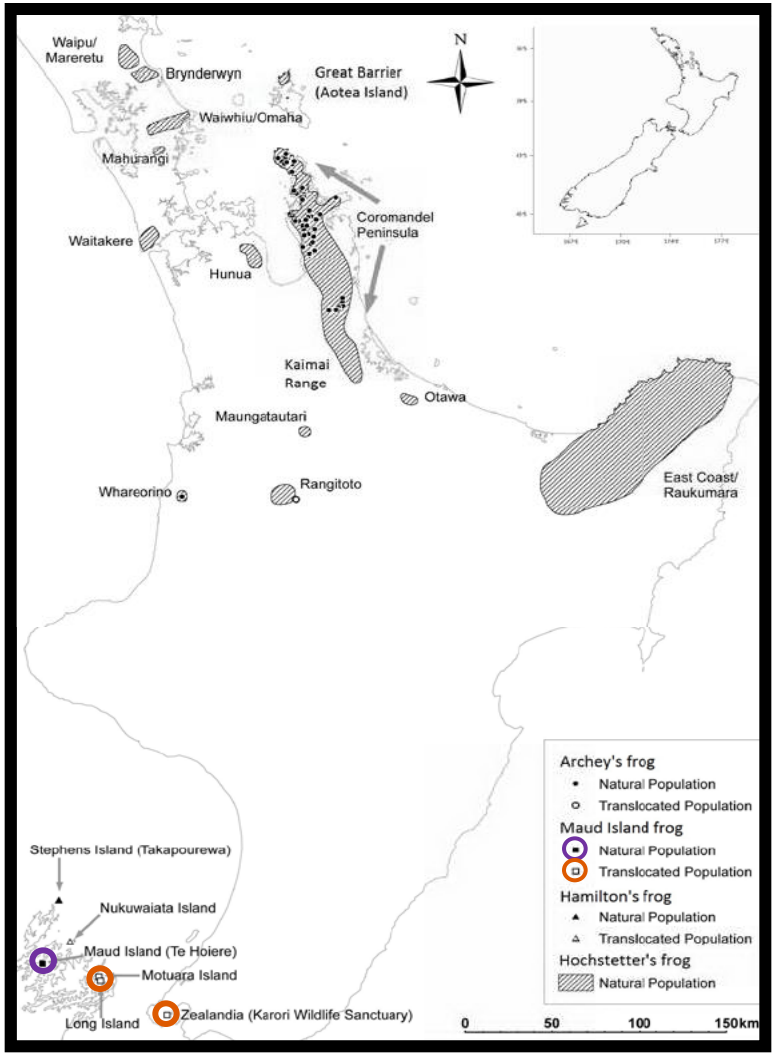

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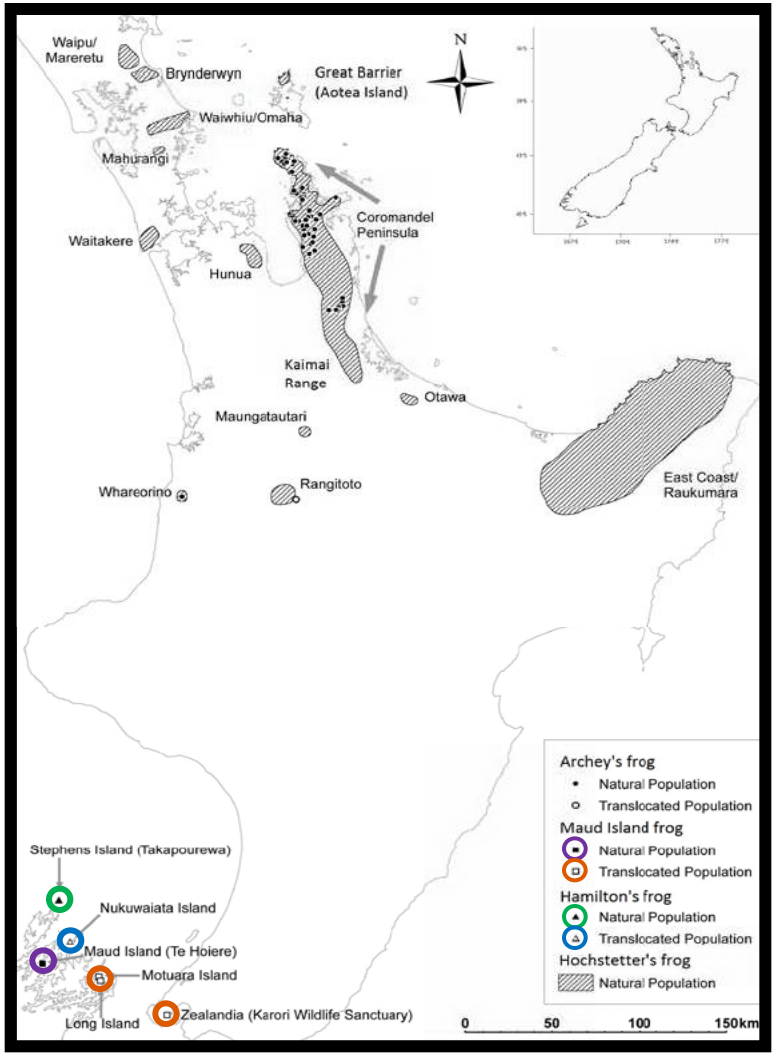
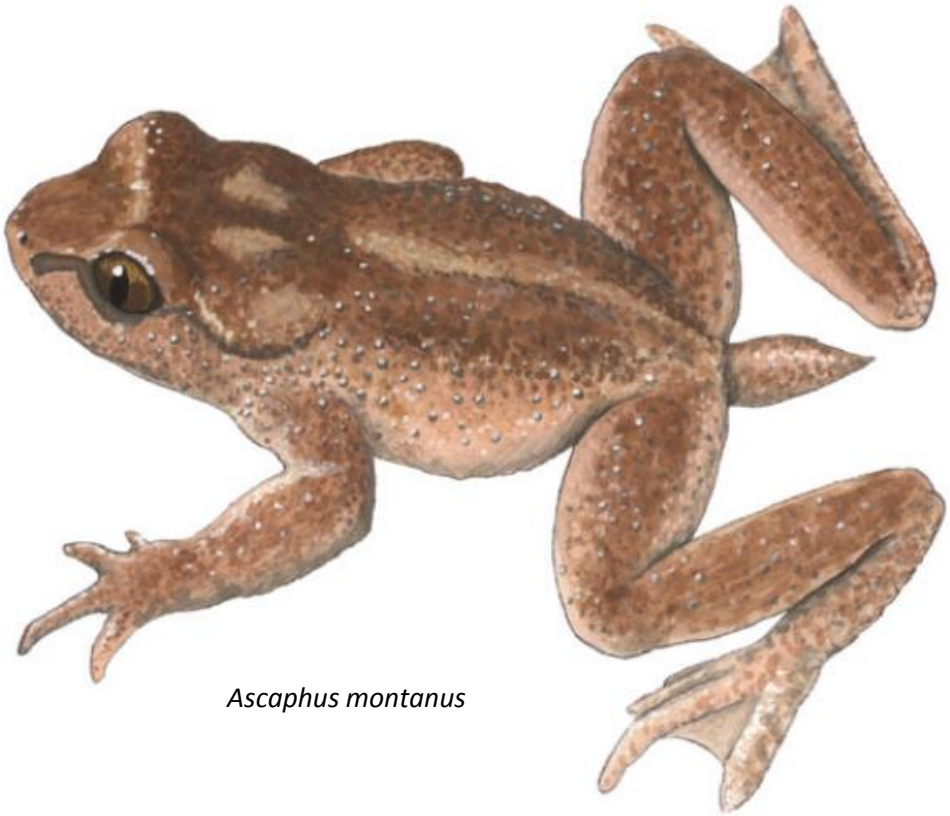


Evolutionarily Distinct

- Endemic genus – *Leiopelma*
- Closest relative – tailed-frog (*Ascaphus*)



Ascaphus montanus

Evolutionarily Distinct

- Characteristics of primitive frogs:
  - Extra vertebrae
  - Tail-wagging muscles
  - Poor jumping ability (“belly flop”)
  - Inscriptional ribs

Declines and Extinctions

- **Extinctions**
  - 3 since human settlement
  - 2 long extinct
- **Living species**
  - Range restrictions/remnant populations
  - Localised extinctions
  - Population declines

Conservation status NZ

	2013 assessment	2018 assessment (in press)
Hamilton's frog	Nationally Critical	Nationally Vulnerable
Archey's frog	Nationally Vulnerable	At Risk- Declining
Maud Island frog	Nationally Vulnerable	Taxonomically indistinct
Hochstetter's frog	At Risk- Declining	At Risk- Declining

Habitat

- Archey's – native 'cloud' forest, 200-1000m asl.
- Hochstetter's – native & exotic forest up to 1000m asl.
- Maud & Hamilton's – remnant coastal forest



Ecology and biology

- Features different to ‘modern’ frogs


  - Don’t croak
  - No external ear drum
  - Round, not slit eyes

- Nocturnal
- Long lived
- Low recruitment, slow growth (K- selected)
- Unusual reproductive behaviour

Reproductive biology

Lay yolk-filled eggs / young feed after metamorphosis

Terrestrial species

- Small egg clutches
- Under rocks, logs
- Male parental care

Hochstetter's frog:

- Small egg clutches
- Under cover alongside streams/seepages
- No evidence of direct parental care

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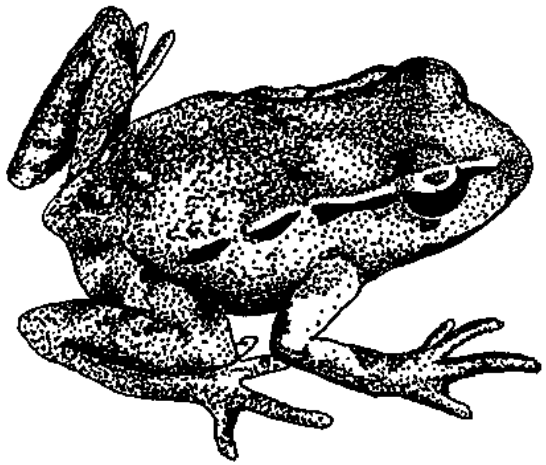

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Threats

- Introduced mammalian predators/pest
- Deforestation (native and exotic)
- Development– roading, subdivision, mining
- Disease
- Introduced amphibians (predator/disease vector)
- Climate change



Predators

- Rats (confirmed)
- Mice (likely)
- Bell frogs (confirmed)
- Pigs (predator or scavenger?)
- Tuatara, kiwi (??)

Disease

Amphibian chytrid fungus

- significant concern 10 years ago
- Likely cause for 80+% Archey's frog decline Coromandel
- Endemic in Archey's populations
- Not detected in other species

Other strains or diseases could be catastrophic

Alien amphibian

- European alpine newt liberated – east Waikato
- Close to native frog populations
- Under eradication – MPI, DOC, WRC
- Disease vector / potential predator

Recovery Strategies

Goal: Leiopelma taxa are no longer threatened by 2050

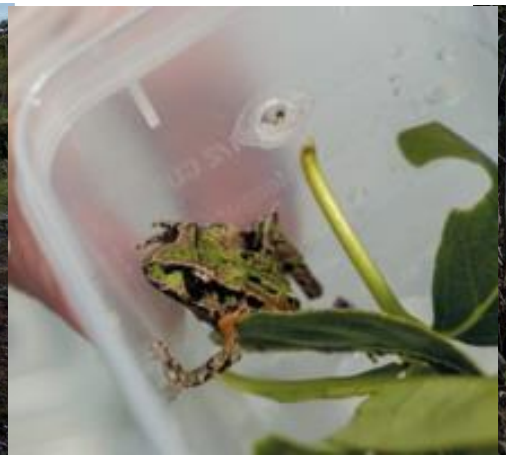
- Research causes of decline
- Secure from extinction
- Protect existing populations
- Establish new populations

Management Actions

- Disease biosecurity
- Predator control (rats)
- Island biosecurity
- Translocation
- Habitat maintenance/restoration
- Population monitoring
- Captive management

Translocations

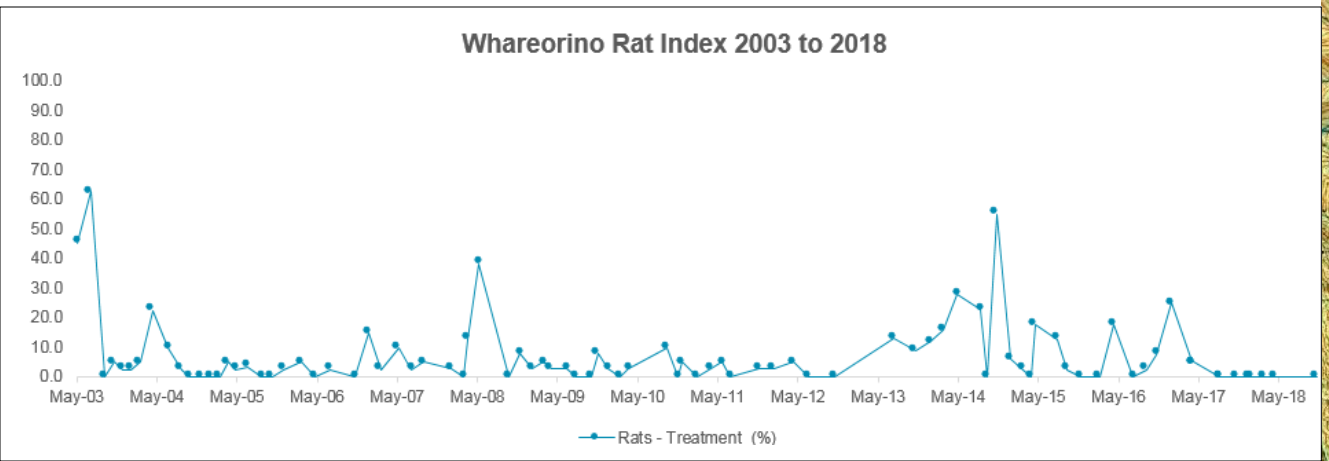
- Maud Island frog – five, one failed
- Hamilton's frog – one, now 2 populations
- Archey's frog – one
- Hochstetter's – none
- Refining techniques

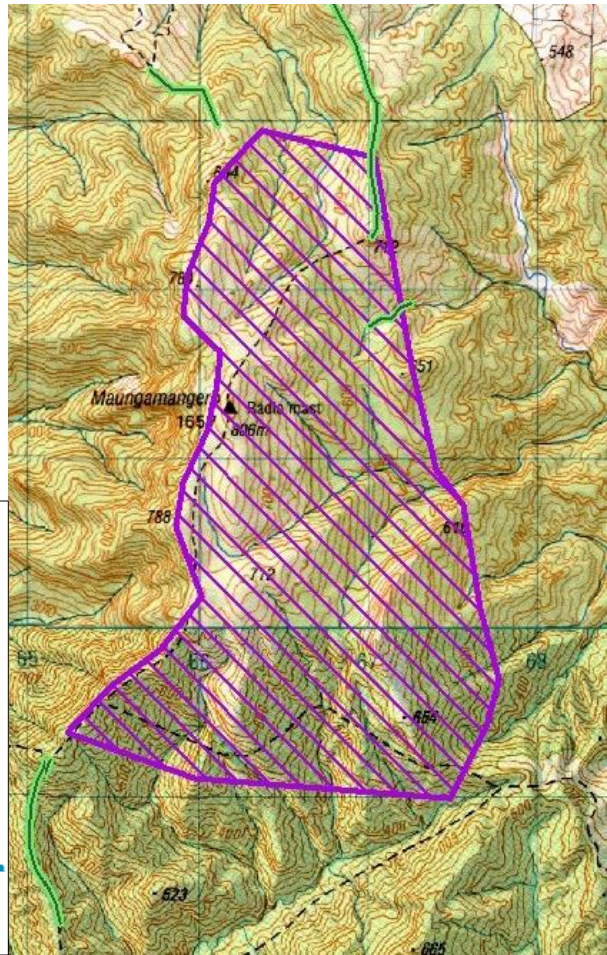




Case studies

Does release from rat predation benefit Archey's frog?

- Whareorino Forest
- 600 ha – Treatment/Non Treatment
- Continuous rat suppression
- Frogs monitored – 4 plots (T/NT)

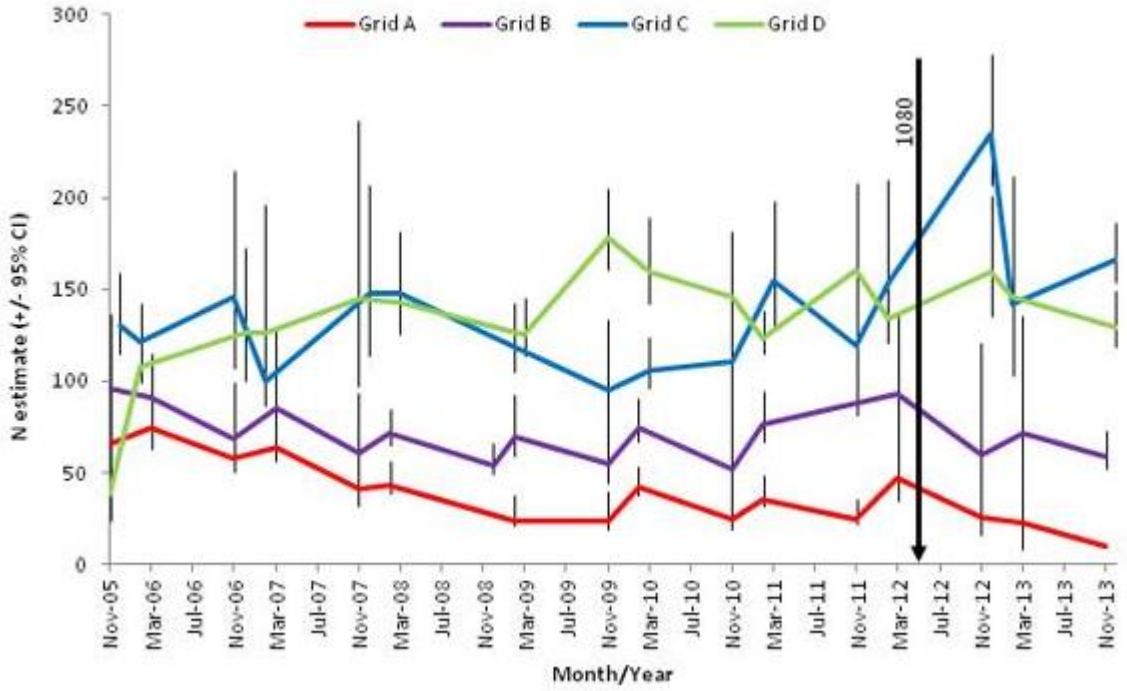




Case studies

Does release from rat predation benefit Archey's frog?

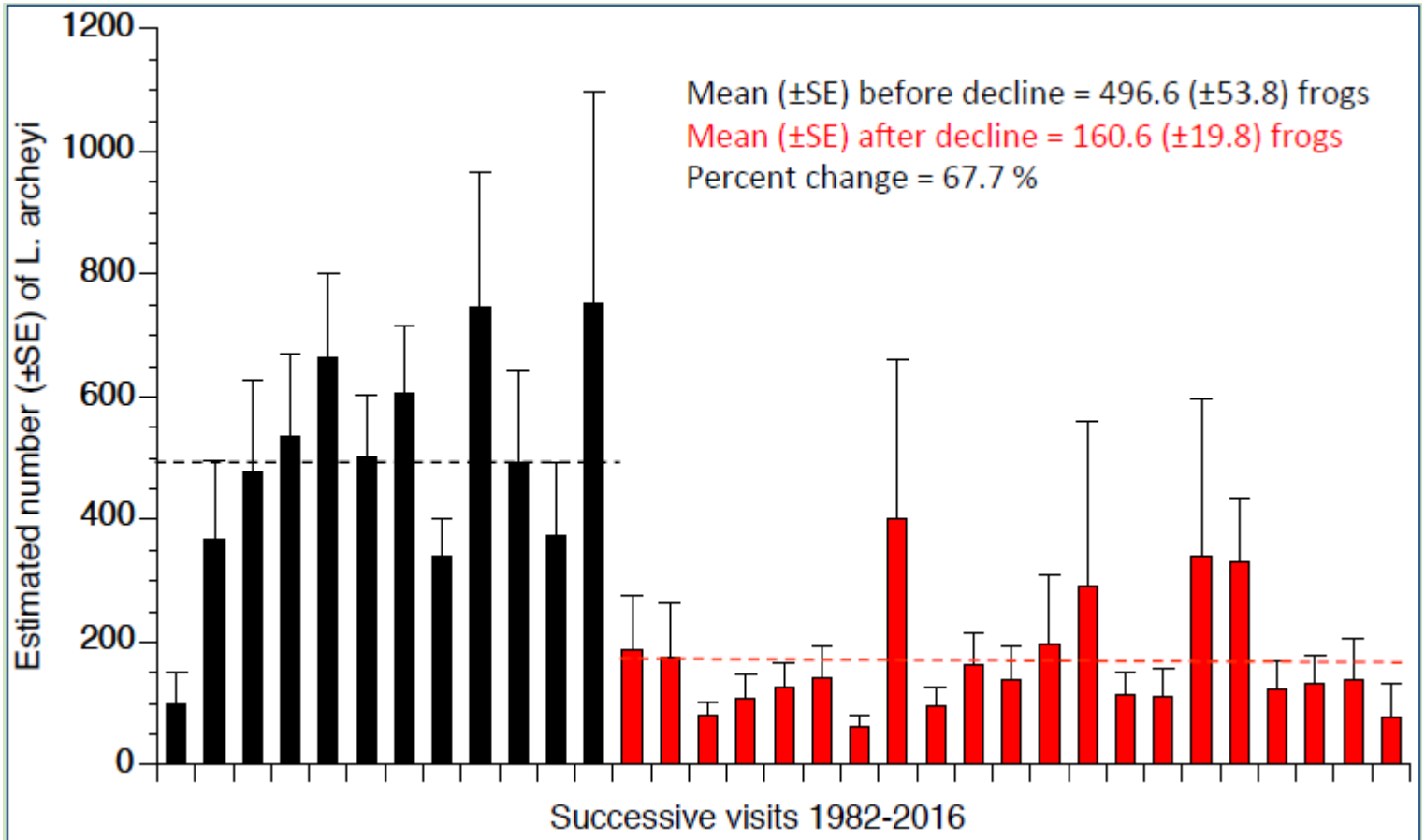
- Difference in population size between T/NT plots
- Next step – rat suppression in Non-Treatment



Case studies

Archey's frog – long-term study – Coromandel

(source: Dr Ben Bell, VUW)



Case studies

Archey's frog – long-term study – Coromandel

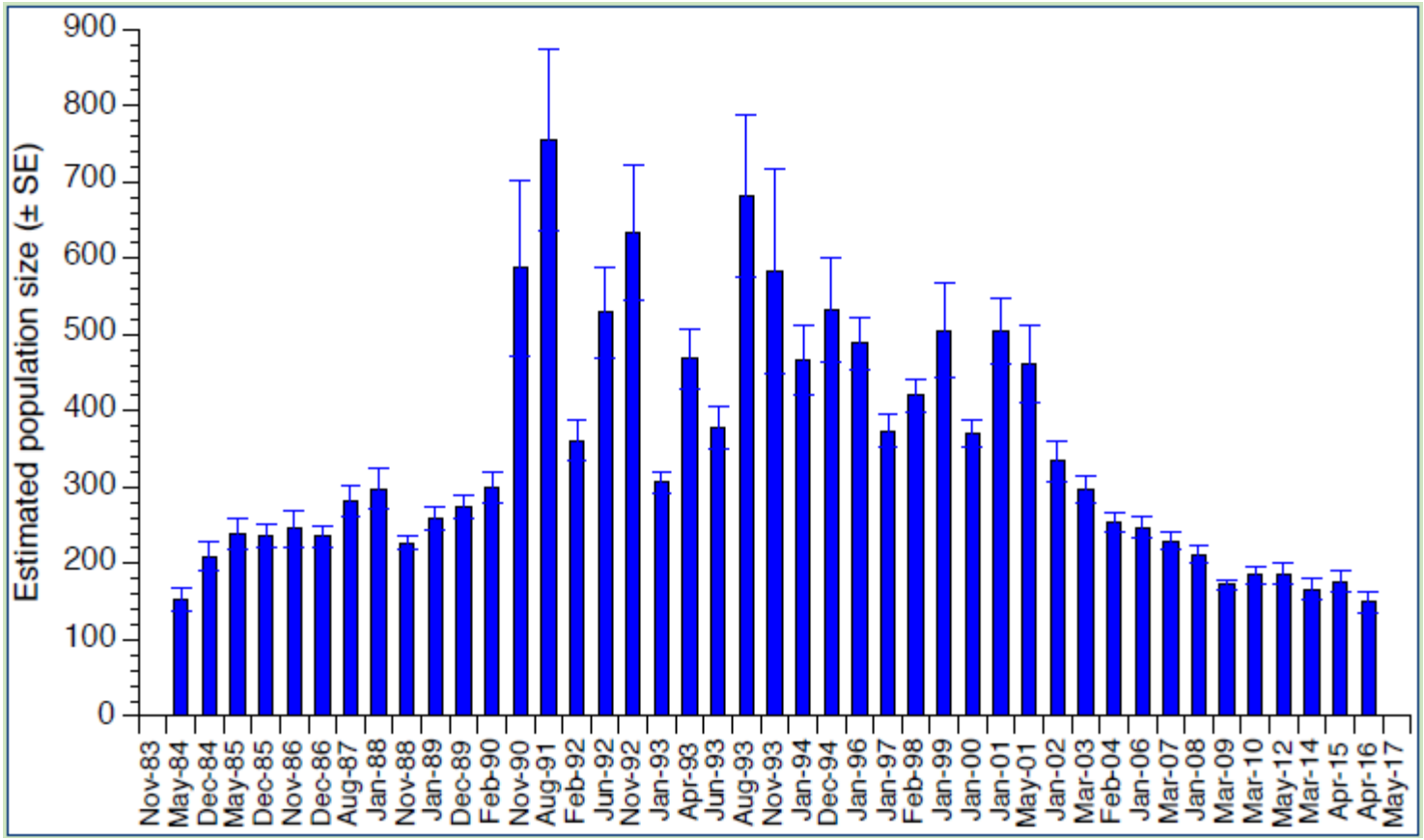
(source: Dr Ben Bell, VUW)

Frog id	Sex	Age (years)
47	F	35
431	F	35
413	F	34
166	F	32
64	F	30
142	F	28
583	F	28
121	F	26
616	F	26
7	F	25

Case studies

Maud Island frog – long-term study

(source: Dr Ben Bell, VUW)



Case studies

Maud Island frog – long-term study

(source: Dr Ben Bell, VUW)

Frog id	86	148	153	29	11	22	57	90	123	2	34	3	31	158	182	8	98	103	170	7	42	82	130	200	5	19	95	100	157	62	144	147	61
Sex	F	M	F	F	F	F	F	F	F	F	F	F	U	M	F	M	U	M	M	M	U	F	M	M	M	F	U	M	M	F	M	M	F
Age (years)	43	43	43	42	40	40	40	40	40	39	39	38	38	38	38	37	37	37	37	36	36	36	36	36	35	34	34	34	34	33	33	33	31

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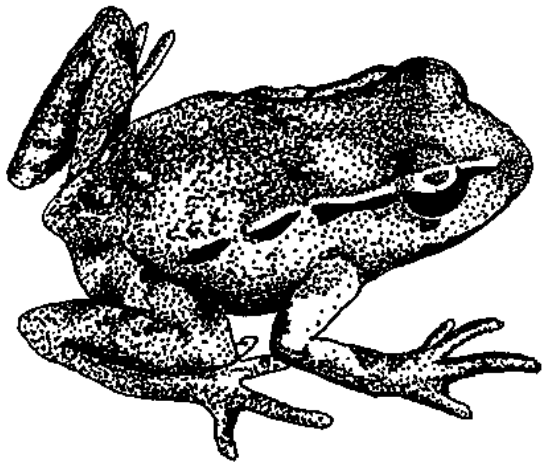

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Threats

Predators

- DNA-based diet analysis reliably detects amphibians as prey
  (Bastian Eteger *et. al.* 2014)

Disease

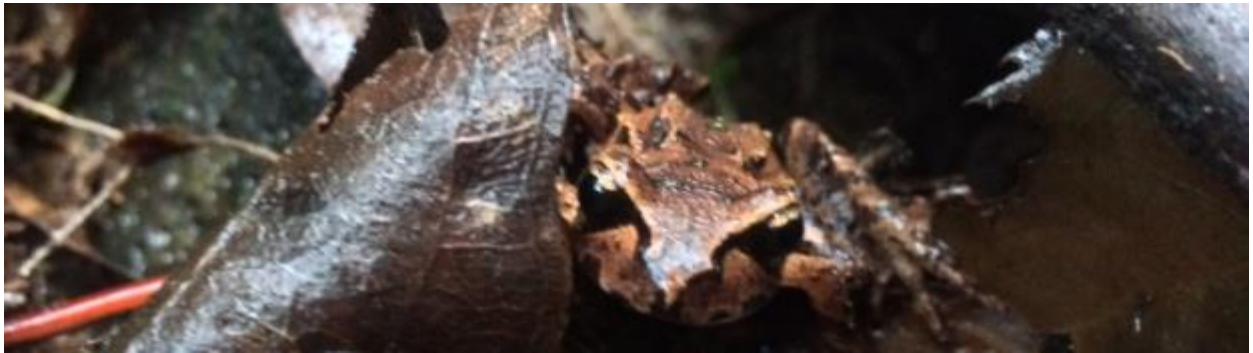
- Low susceptibility to chytridiomycosis/self cure
  (Bishop *et. al.* 2009, Shaw *et. al.* 2010, Melzer & Bishop 2010, Ohmer *et al*. 2012,)
- Captive frogs need calcium, UV light; and defluorinated water
  (Shaw *et. al.* 2011)

Biology/Ecology

- Reproductive cycles and sex determination via urinary hormones
  (Germano *et. al.* 2011, 2012)
- Affirming water balance and thermoregulation are important to microhabitat selection
  Ramirez *et al*. 2017)
- Fluorescent powders can track fine-scale native frog movements
  (Ramirez *et al.* 2017)

Biology/Ecology

- Four-fold increase in Hochstetter's frogs on Maungatautari Mt
  (Longson *et. al.* 2017)
- Translocation habitat assessment – Hochstetter's & Archey's frog
  (Easton *et al*. 2016, Javiera Cisternas Tirapegui *pers com*)
- Archey's frog may exhibit fidelity to breeding sites
  (Javiera Cisternas Tirapegui *pers com.*)



Genetics/Taxonomy

- Hochstetter's frog consists of 13 Evolutionarily significant units
  (Foquet *et. al.* 2011, Luke Easton unpublished data)
- Ancient DNA shows extinction of cryptic species, and ESUs
  (Luke Easton Luke Easton unpublished data)
- Maud Island and Hamilton's frog – 2 ESUs, not separate species
  (Thurlow 2016, Luke Easton unpublished data. 2017, Burns *et al.* in press)

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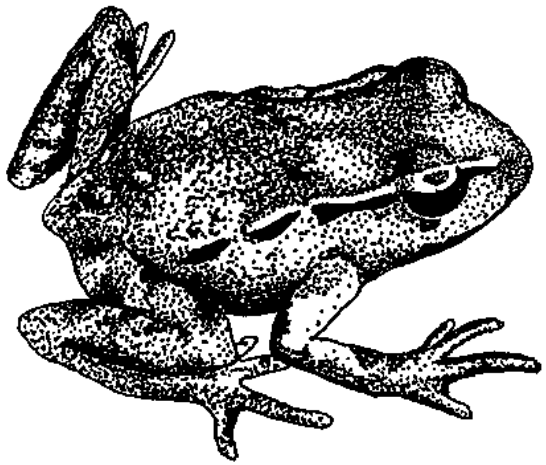

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Challenges/gaps

- Targetted *insitu* management limited
- Unexplained gaps in distribution
- Effective mitigation for land use activities lacking
- Understanding of pig and mice impacts
- Monitoring methods for low density populations
- Fine tuning translocation methods
- High labour costs of photo ID

Where to next?

- Recovery plan review
- Ramp up *insitu* management
- Further distribution surveys
- Reassess & progress translocation priorities
- Update translocation habitat assessments

Where to next?

- Continue to test predator control regimes
- Investigate impact of pigs
- Trial computer-assist photo ID
- Trial occupancy modelling – Archey's frog
- Ensure we measure population outcomes

Questions?

Acknowledgements (data/images):

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