New Pest Control Tools

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IPC INVASIVE PEST CONTROL

Connovation CONSERVATION BY INNOVATION

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THE UNIVERSITY OF AUCKLAND NEW ZEALAND Te Whare Wānanga o Tāmaki Makaurau

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Background

Why PCT?

Rodenticide developments

2000 BC to present

Global and NZ tailored development

WHY INVEST SO MUCH EFFORT IN PCT?

- no terrestrial mammals (bats/marine)
- birds filled niche
- rats on sailing ships 1800s
- possums for fur
- multi-species pest impacts


Mohua


Kokako

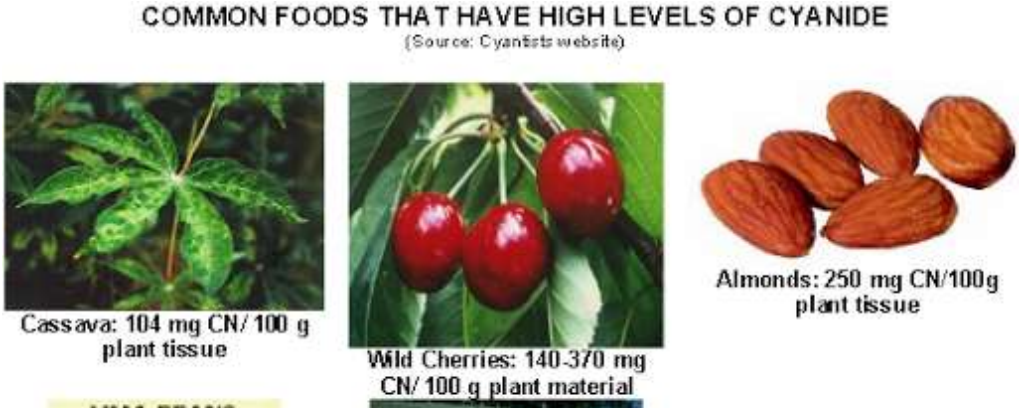

Kereru


Tieke -saddleback

RODENTICIDE HISTORY

Toxin developments	Comments
Red squill, strychnine, arsenic, cyanide,	**Ancient or older toxins date back hundreds/or thousands of years**
Sodium fluoroacetate, warfarin (1950s), diphacinone, (1961), brodifacoum (1970s)	**Established tools globally mostly now anticoagulants**

Natural products link to or have inspired most – each has a story



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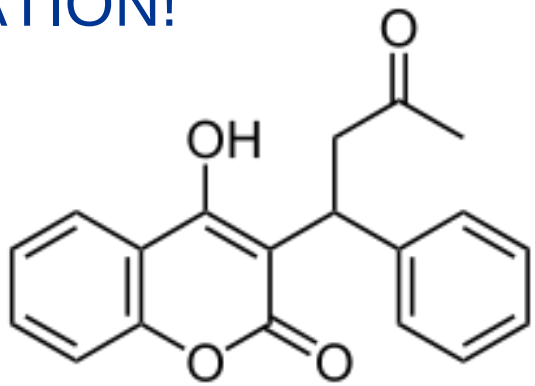
ANTICOAGULANTS – CHANCE OBSERVATION!



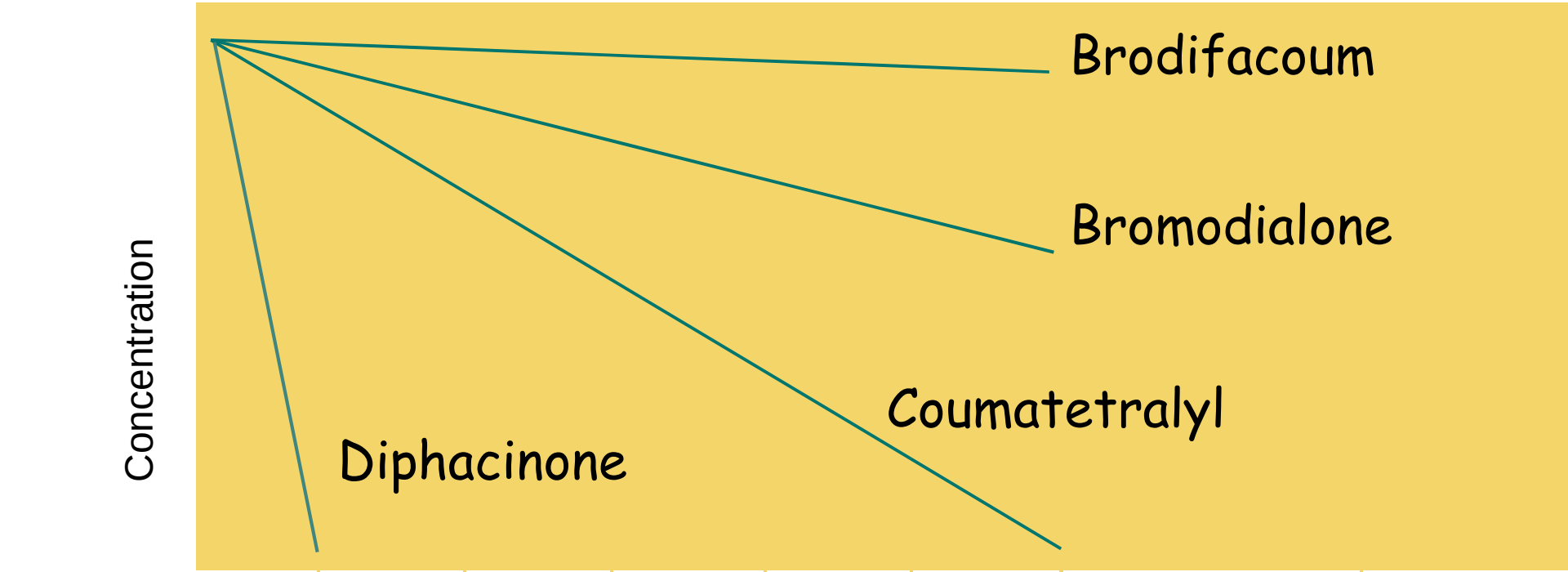
- 1920s bleeding cattle – mouldy hay
- 1939 caused by naturally occurring dicoumarol
- 1940s >100 analogues
- 1948 No.42 Wisconsin Alumni Research Foundation (WARF) = **warfarin** (LD_{50} 10-20 mg/kg)
- 1955 President Eisenhower treated
- 1950–80s Inspired other rodenticides e.g diphacinone and potent SGAR's e.g brodifacoum

BRODIFACOUM –ISLAND CONSERVATION one–off application

- >120 island pest-free sanctuary
- 1970's Titi Island (32 ha)
- more ambitious, effective use of brodifacoum
- 1998 Kapiti Island (1965 ha), 2001 Campbell (11,300 ha)
- Great barrier – Stewart Island?
- Global conservation programmes >500 islands

MAKING THE RIGHT CHOICE:- Anticoagulants

- slow acting can be single or multidose
- persistence profile & repeated use

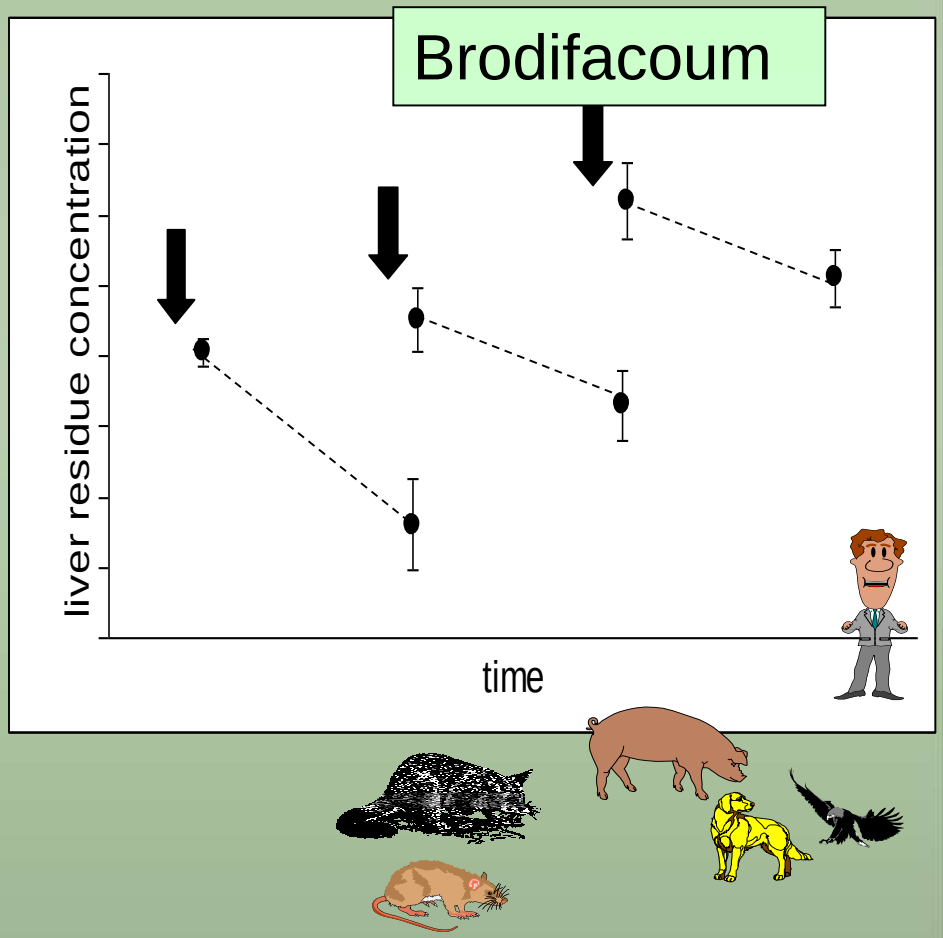


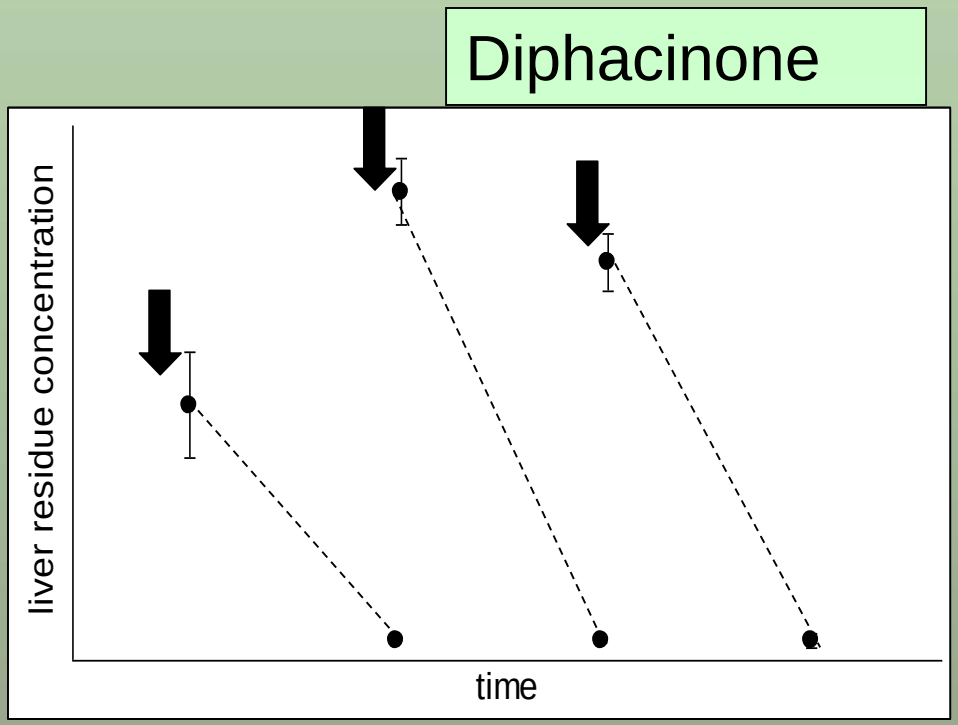
BIOACCUMULATION IN NON-TARGETS

Persistent compounds

- secondary poisoning
- non-target deaths
- residues in game and livestock

Still need to use toxins but use with an understanding of their properties



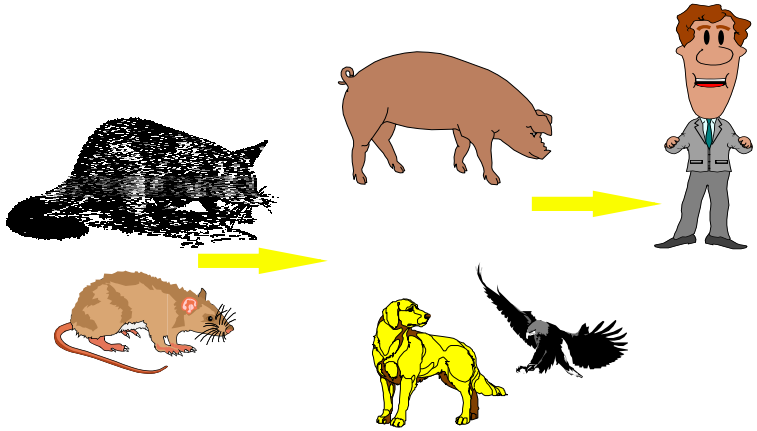


SUSTAINED FIELD USE: leads to accumulation.

Residues of brodifacoum found in wildlife surveys

- Weka
- Pukeko
- Grey duck
- Harrier
- Black Backed Gull
- Robin
- Kiwi
- Saddleback
- Chaffinch
- Mynah
- Magpie
- Blackbird
- Mallard Duck
- Morepork

Pig
Deer
Goat



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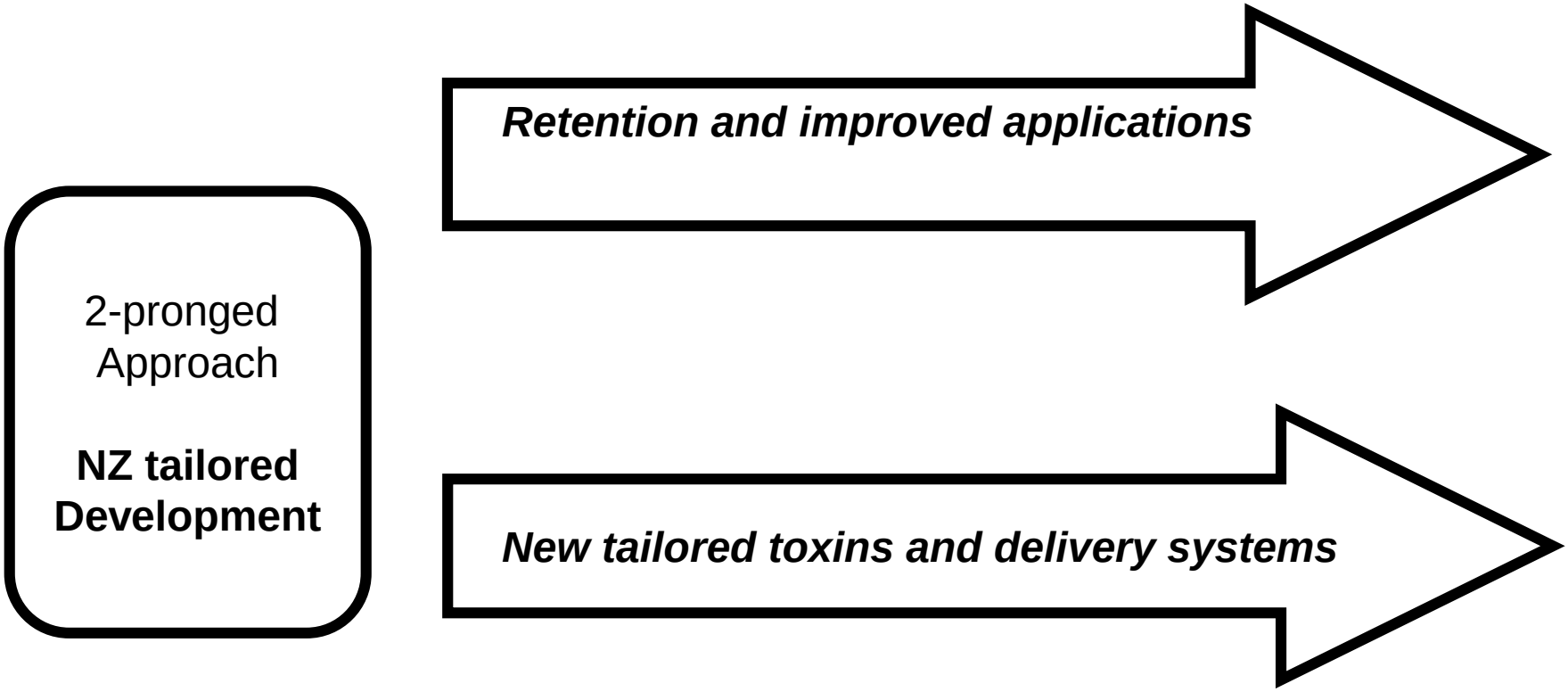
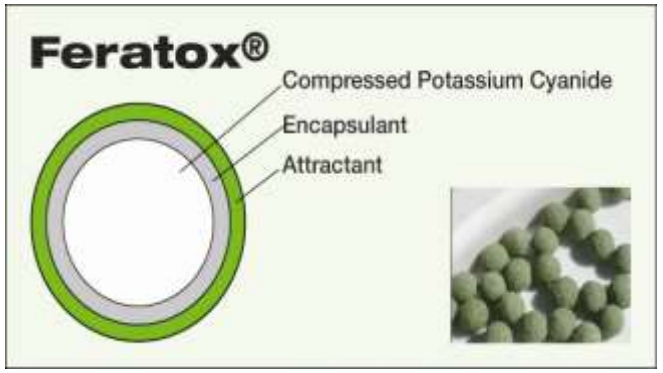


Including fast acting (single dose) and slow acting to use in IPM

Tailoring a traditional toxin for NZ application, cyanide in a pellet

- **Feratox® registered 1997 for possums, single–dose & used routinely**

- kills "on the spot" (50 cents/kill)
- no residues or bioaccummulation
- no secondary poisoning
- proven humaneness in possums
- extended registration to wallabies 2009/10 -alternative to 1080



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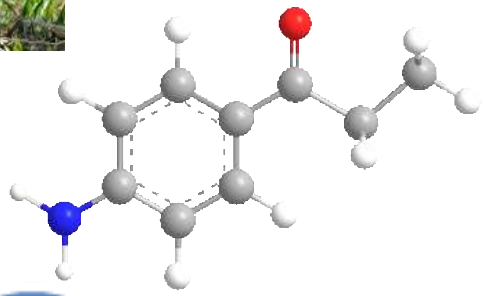
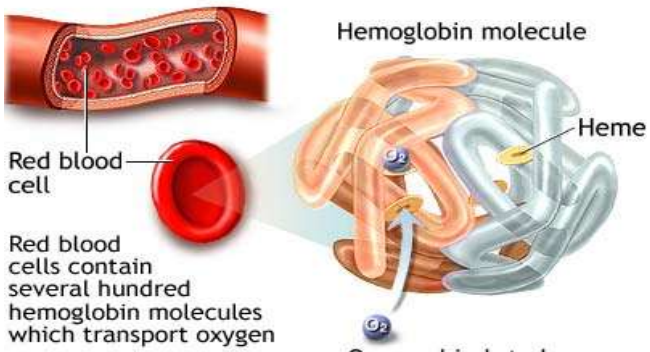
Tailoring a new toxin for NZ- PAPP (para-aminopropiophenone)

- **PredaSTOP® 2012 single dose for stoats**
  - 1st new >30 yrs
  - Humane- low or no residues
  - 2015 approved in Australia for foxes



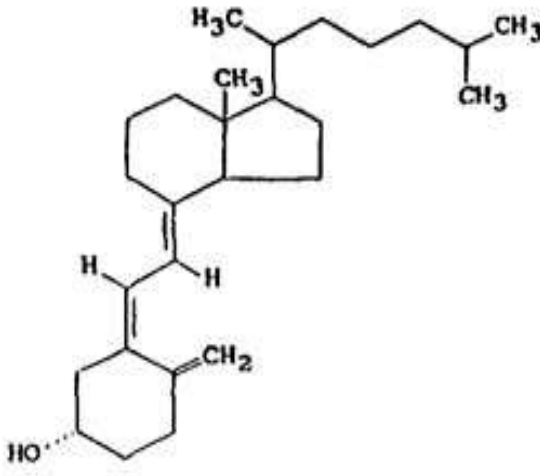
Eason et al 2014. A new predator control tool. NZ of Ecol, 38(2), 177-188.



Tailoring a toxin developed overseas for NZ- 0.8 % cholecalciferol or Vitamin D_3

Feracol® late 1990's single dose possums & rodents

- Synthesised in skin, fish oils & egg yolk
- Rodenticide USA
- Low secondary poisoning
- Low toxicity to birds LD_{50} >2,000 mg/kg



Eason et al 2000. Non-target and secondary poisoning risks associated with cholecalciferol. Proc NZ Plant Protect Conf 53: 299–304.

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Tailoring a toxin developed overseas for NZ - diphacinone

RatAbate® late 1990's rodents slow acting

- Used since late 1990's
- Low residue no secondary poisoning
- FGARS not potent enough to kill possums or rats resistant to anticoagulants

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New tailored toxin(s) for NZ applications

DOUBLE TAP PELLET BAIT for the control of POSSUMS & RATS **and slow acting**

- Diphacinone with small amount of cholecalciferol
- No CSL required, as with brodifacoum – no pre-feeding required
- Effective on possums and rats with a single feed (or several)
- Global concerns re field use of SGARs
- Comparable potency to brodifacoum – low residue risk

Diphacinone (0.005 %)	**Cholecalciferol 0.06 %**	**Registration NZ 2019**

In development – norbormide

Species	LD 50 mg/kg
Norway rat	4-15
Ship rat/black rat	52
Hamster	140
House mouse	2,250
Pig	>1,000
Sheep	>1,000
Cat	>1,000
Dog	>1,000
Duck	>1,000
Monkey	>1,000
Pigeon	>1,000
Turkey	>1,000
Goose	>1,000

- Rat specific - Only known VTA that is truly specific
- Low risk to non-target species
- Fast acting
- Not persistent
- Breakthrough in palatability

Current status - norbormide

- Synthesis of a highly palatable formulation equally effective on Norway and ship rats
- Field trials completed for Norway rats
- Registration process underway with NZ EPA

Field trial sites 2019 near ACK	Pre-monitoring RTI%	Post-monitoring RTI%	Total toxic bait consumed (g)
Site 1	79% (19/24 tunnels)	0%	1477.9
Site 2	100%	4.2% (1/24 tunnels)	390.3

Tailored for NZ – summary

Feratox®	Cyanide pellet	possums
Predastop®	PAPP paste	Stoats
Feracol® RataAbate® DoubleTap®	D+C alone and in combo	Alt to brodifacoum possum & rats
Rodent Specific Toxin	Norbormide	Uniquely species specific-rats

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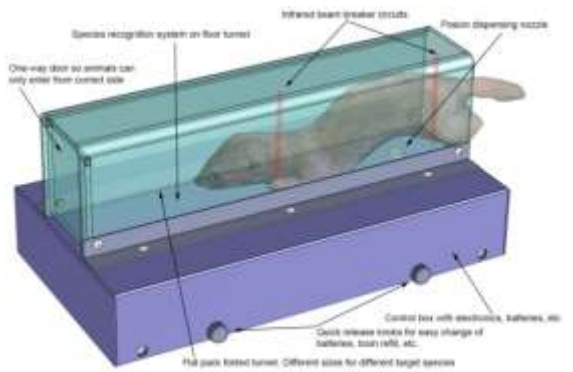
HOW BEST TO USE

- Because SGARS's persist, and bioaccumulate in food-chain, use sparingly
- Use with non-anticoagulants (cholecalciferolol, cyanide) or D+C and traps
- Future- combining targeted toxins and delivery with traps
- IPM- not sole reliance on one tool or toxin



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Unfortunately

“There are no silver bullets”