Landcare Research
Manaaki Whenua

State, trends and vulnerability in New Zealand's indigenous biodiversity

Susan Walker

Manaaki Whenua - Landcare Research, Dunedin

Landcare Research LINK seminar

Wellington, Friday 24th April 2015

Thanks

People

Rachel McClellan, John Sawyer, James Reardon, John Barkla, John Leathwick, Nick Head, Ingrid Grüner, Phil Lyver, Hendrik Moller, Sarah Richardson, Andrea Byrom, Bill Lee, Adrian Monks, Andrew Gormley, John Innes, Rob Schuckard, David Melville, Phil Battley, Hugh Robertson, Adrian Riegen, Richard Allibone, Ron Moorhouse, Josh Fyfe, Kath Walker, Graeme Elliott, Liz Parlato, Craig Wilson, Kate Steffens, Simon Moore, Paul Bradfield, Jessica Scrimgeour, Andrew Smart, Brian Rance, Jeremy Rolfe, Rod Hitchmough, Avi Holzapfel, Richard Ewans, Dave Kelly, Theo Stephens, Ellen Cieraad, Joy Comrie, Andy Hutcheon, Jo Monks, Dave Towns, Hermann Frank, Deb Wilson, Richard Maloney, Fraser Maddigan, Anita Spenser

Organisations

Ornithological Society of NZ, DOC, Landcare Research, NIWA, Wildland Consultants, University of Otago, University of Canterbury, Massey University, Kea Conservation Trust

New Zealand's biota

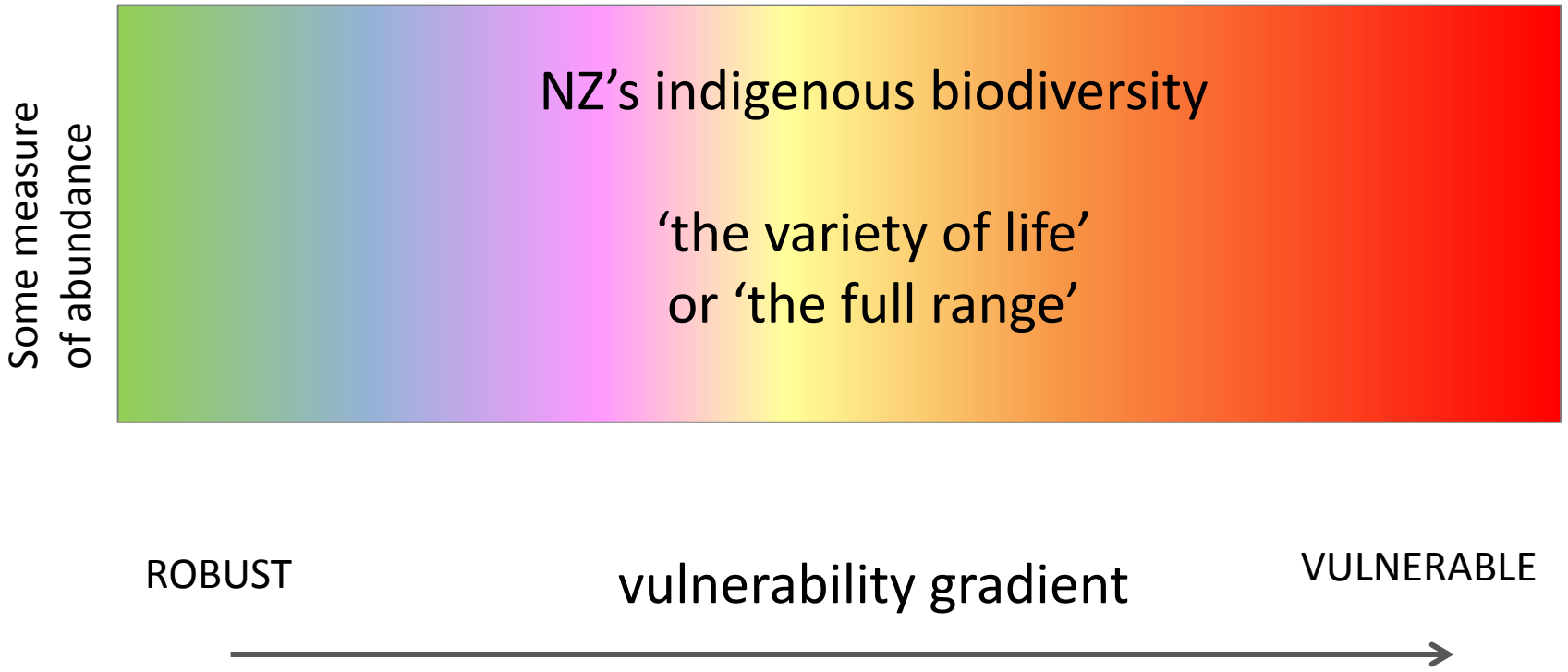
"Exquisitely strange"

Highly endemic

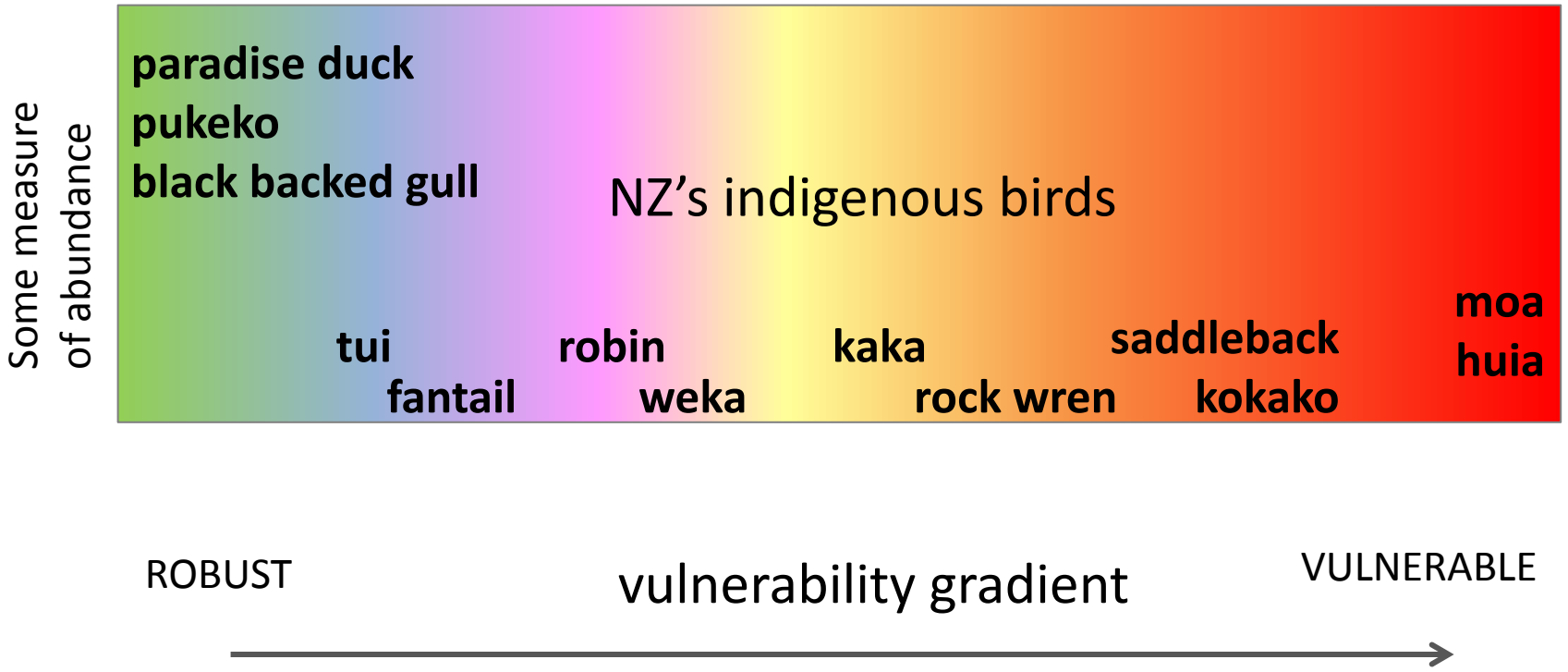
Highly threatened

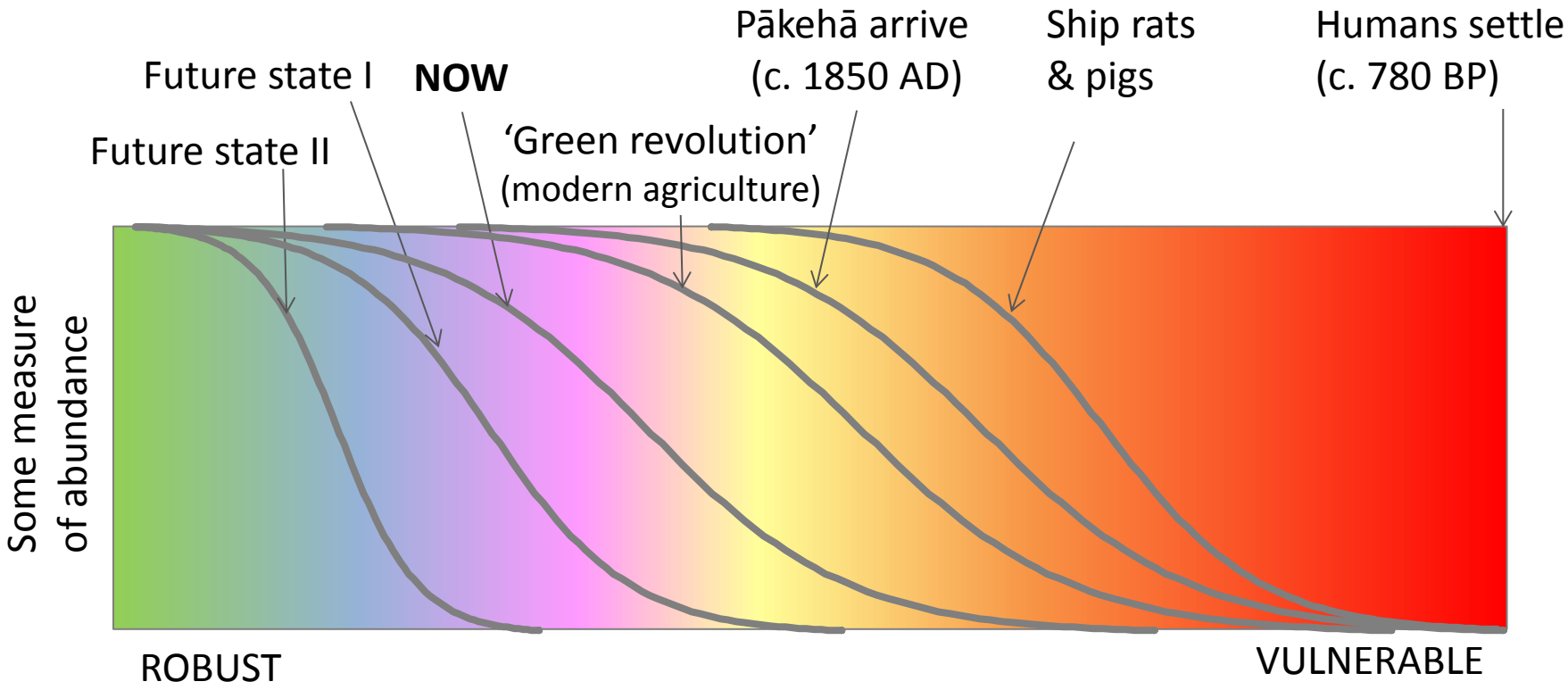
Bradshaw et al. 2010. Evaluating the relative environmental impact of countries. PLoS ONE 5.

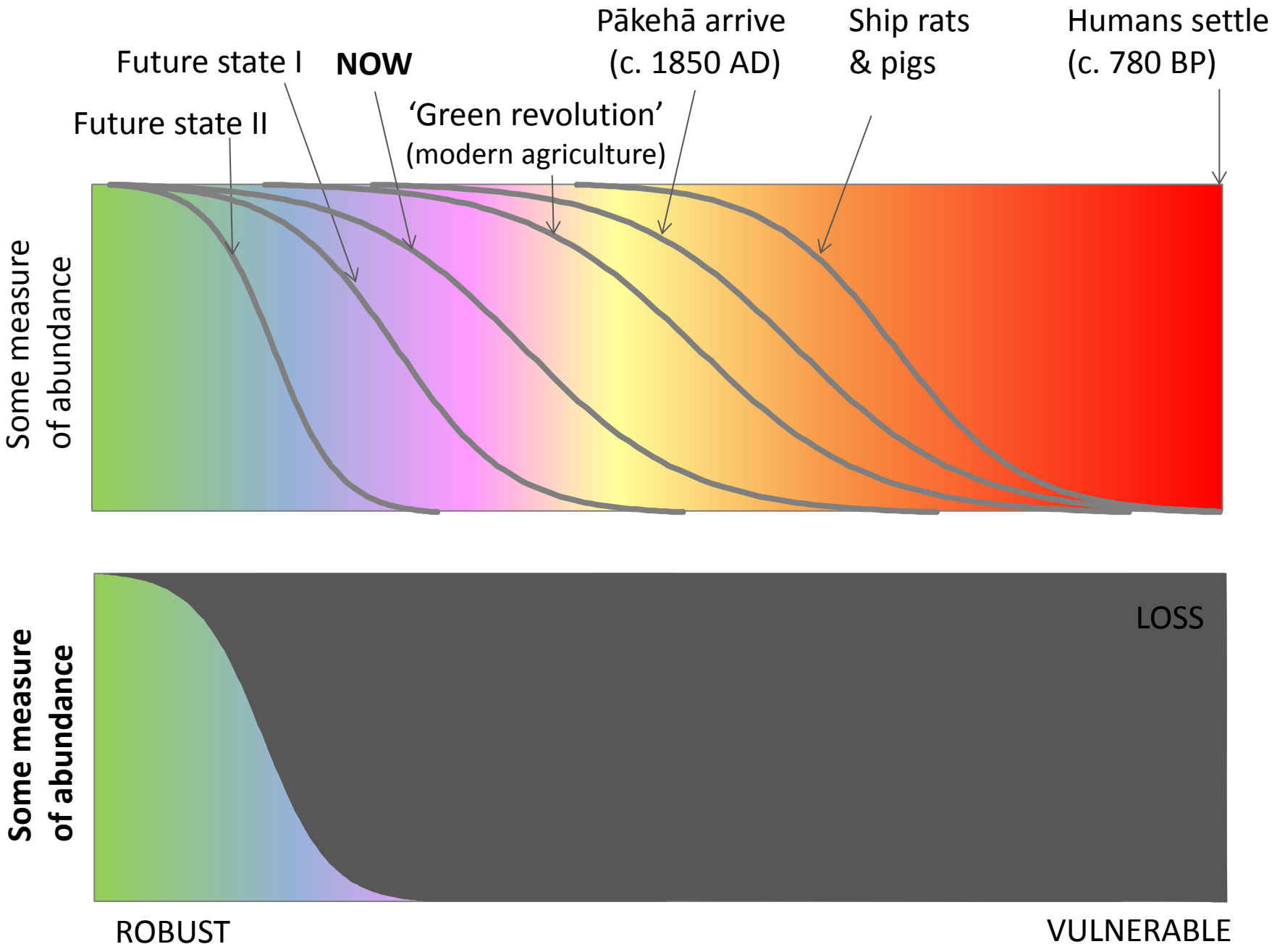
Vulnerability



Vulnerability




Pākehā arrive
(c. 1850 AD)
Ship rats
& pigs
Humans settle
(c. 780 BP)
Future state I
NOW
Future state II
'Green revolution'
(modern agriculture)
Some measure
of abundance
ROBUST
VULNERABLE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Humans settle
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Future state II
'Green revolution'
(modern agriculture)
Some measure
of abundance
Some measure
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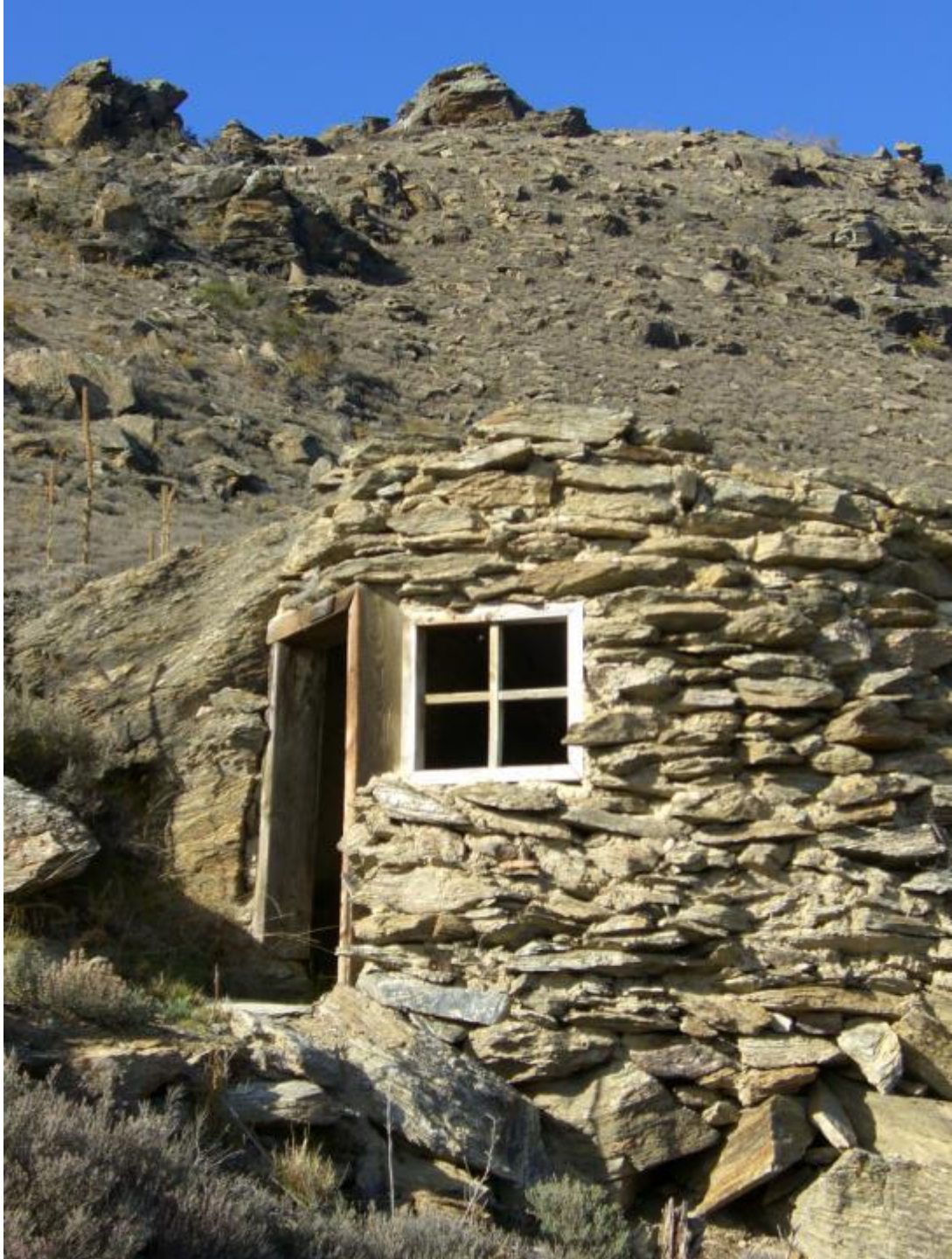
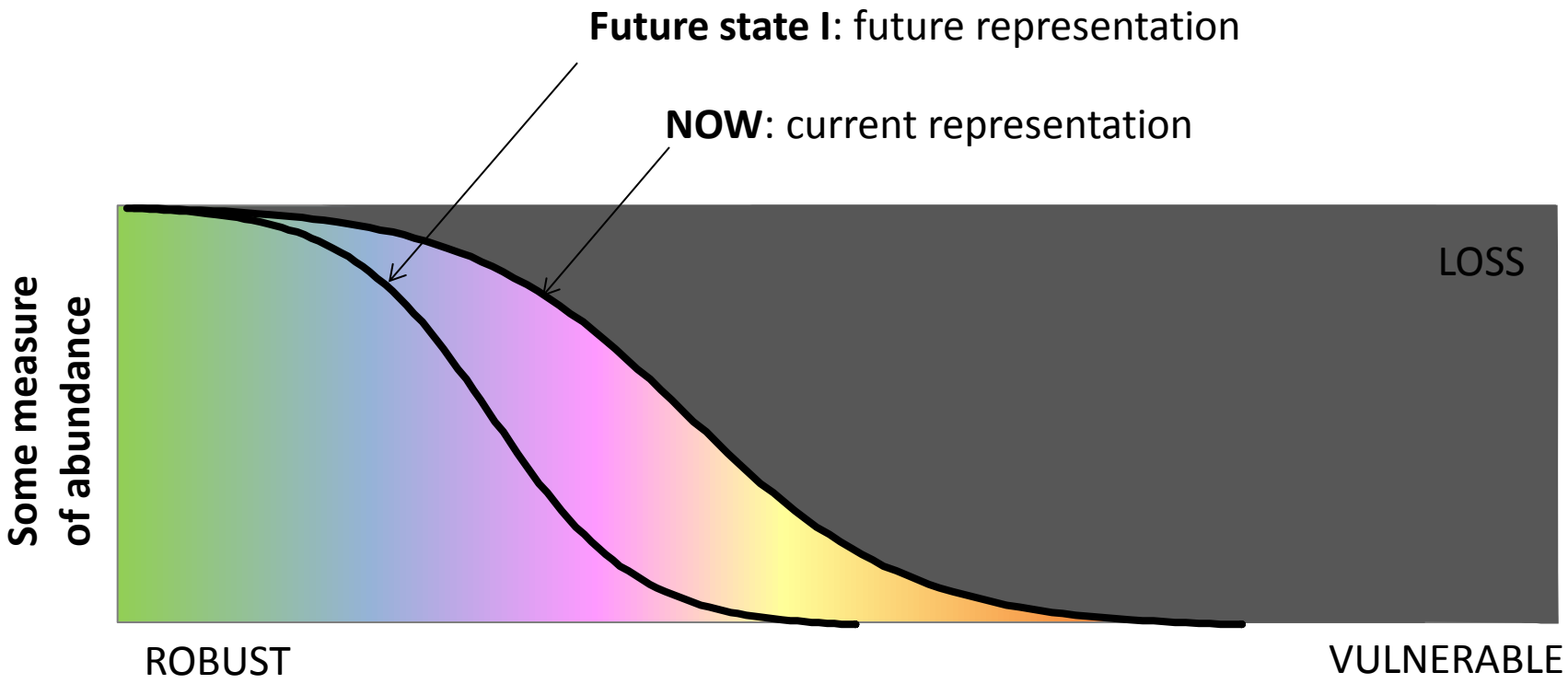
LOSS
ROBUST
VULNERABLE

Analogy



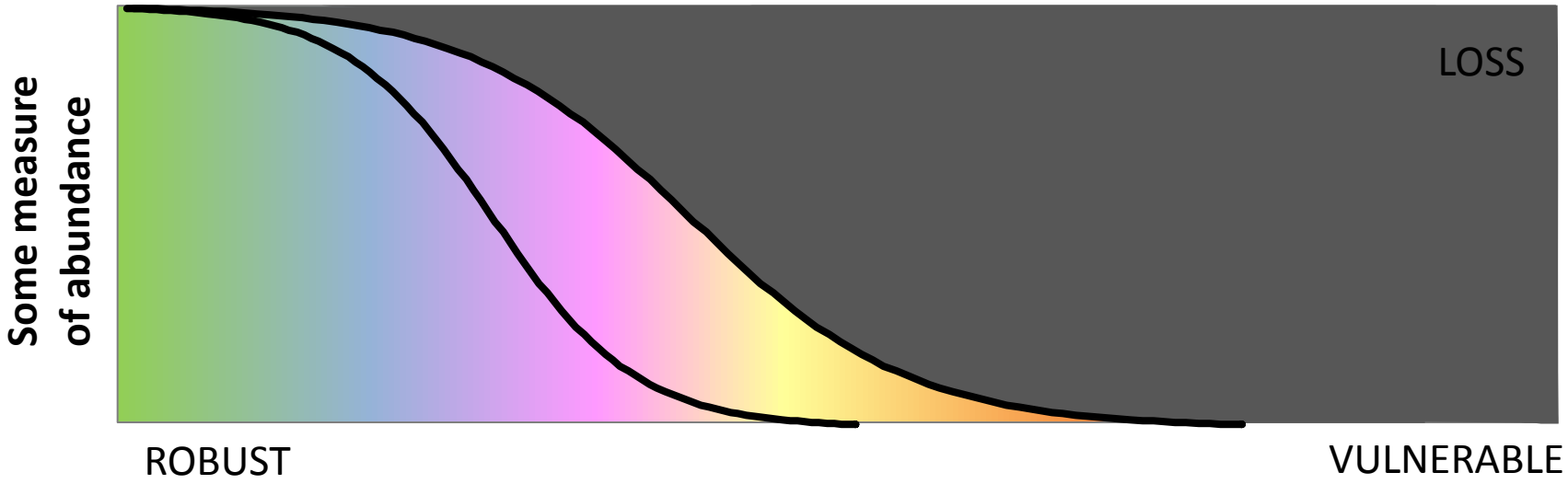
Focus


Future state I: future representation
NOW: current representation
LOSS
Some measure of abundance
ROBUST
VULNERABLE

This talk

Part 1: Indigenous habitats and species between the lines

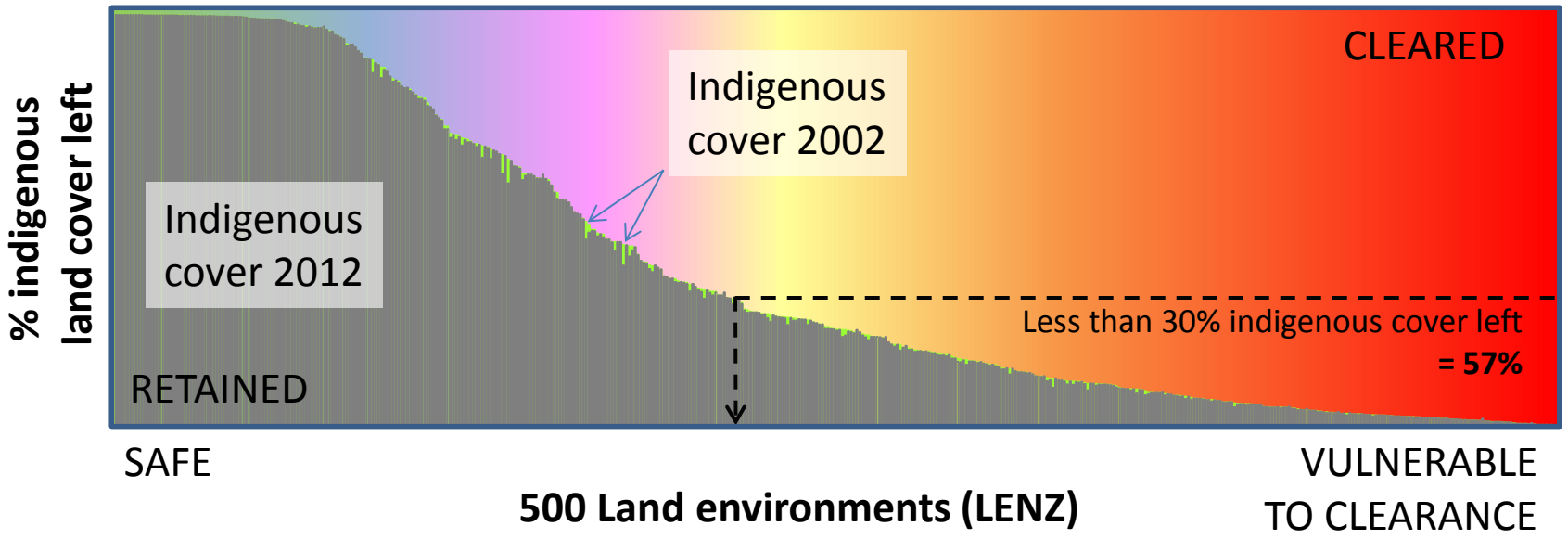
Part 2: A vulnerability-based framework to make the most difference, and its information needs



Indigenous cover in land environments

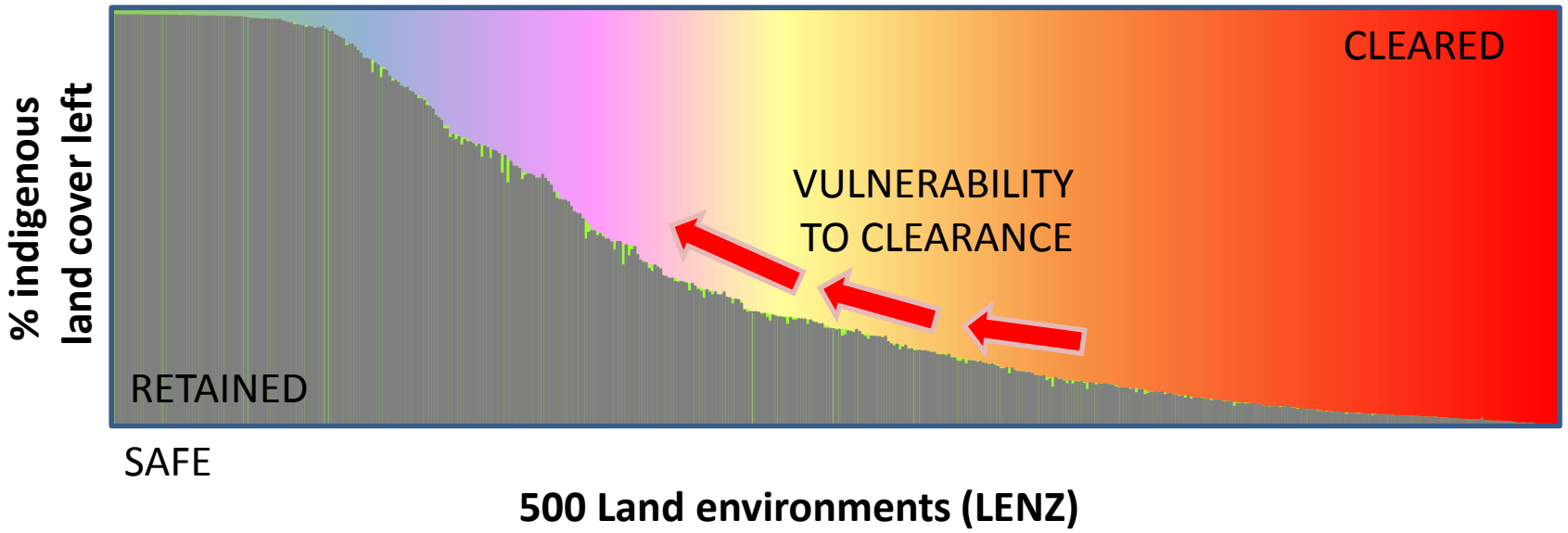
500 Level IV
Land environments
of LENZ

Indigenous cover in land environments



Walker et al. 2006. Recent loss of indigenous cover in New Zealand. New Zealand Journal of Ecology 30: 169–177
Updated by Cieraad et al. (2014, in prep)

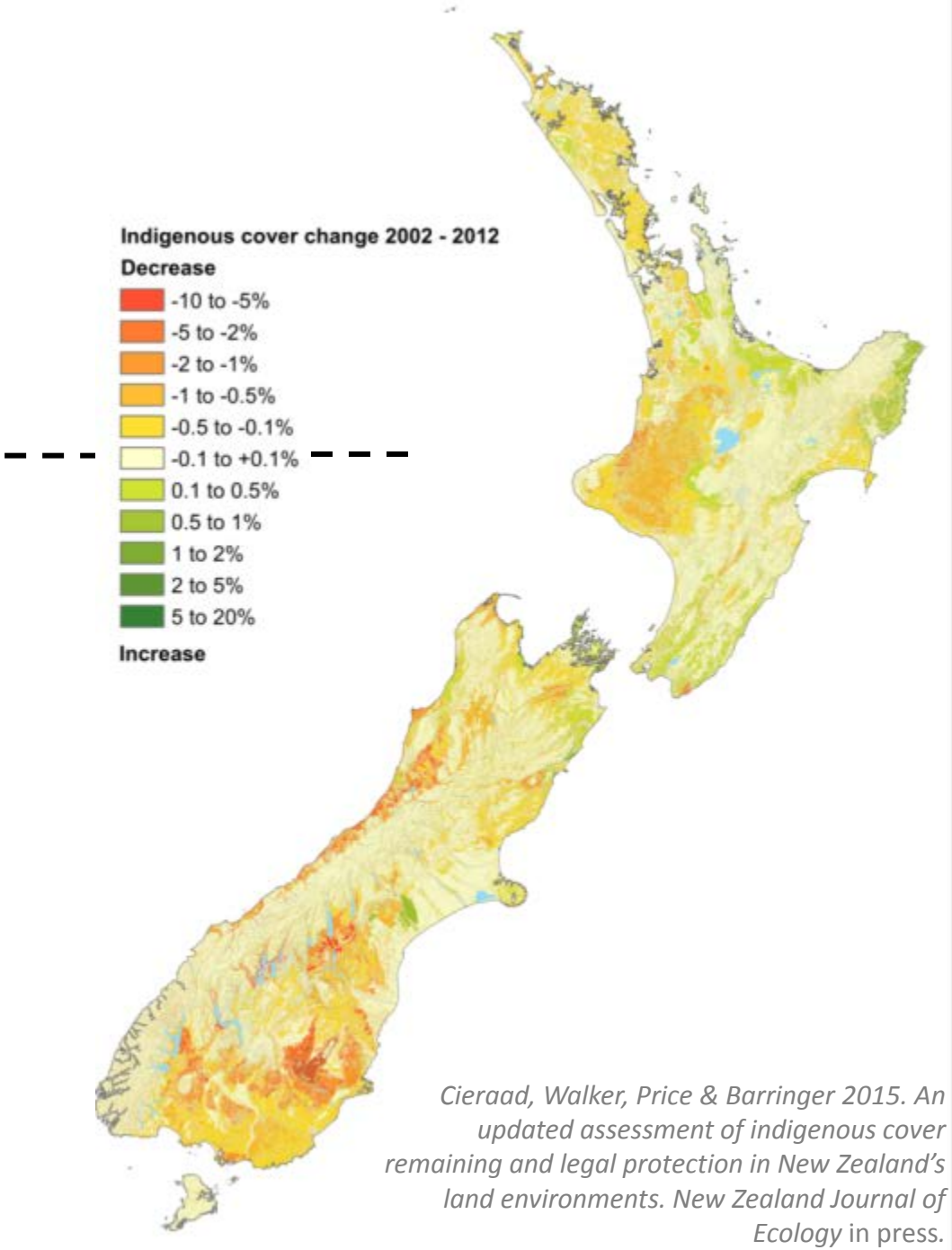
Indigenous cover in land environments



Cieraad, Walker, Price & Barringer 2015. An updated assessment of indigenous cover remaining and legal protection in New Zealand's land environments. New Zealand Journal of Ecology in press

Indigenous cover change in land environments (LCDB4)

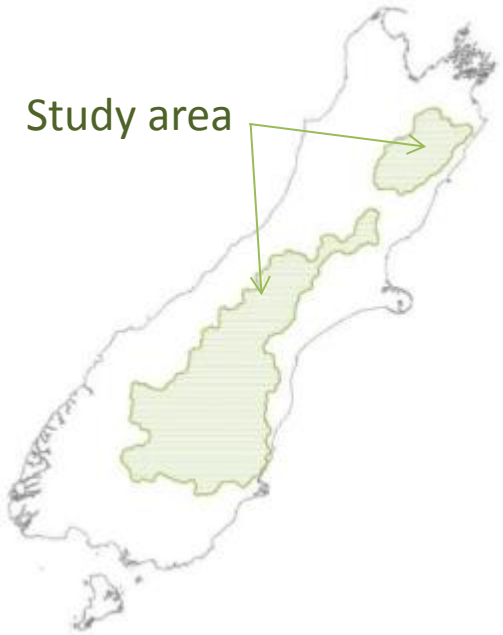
2002 - 2012

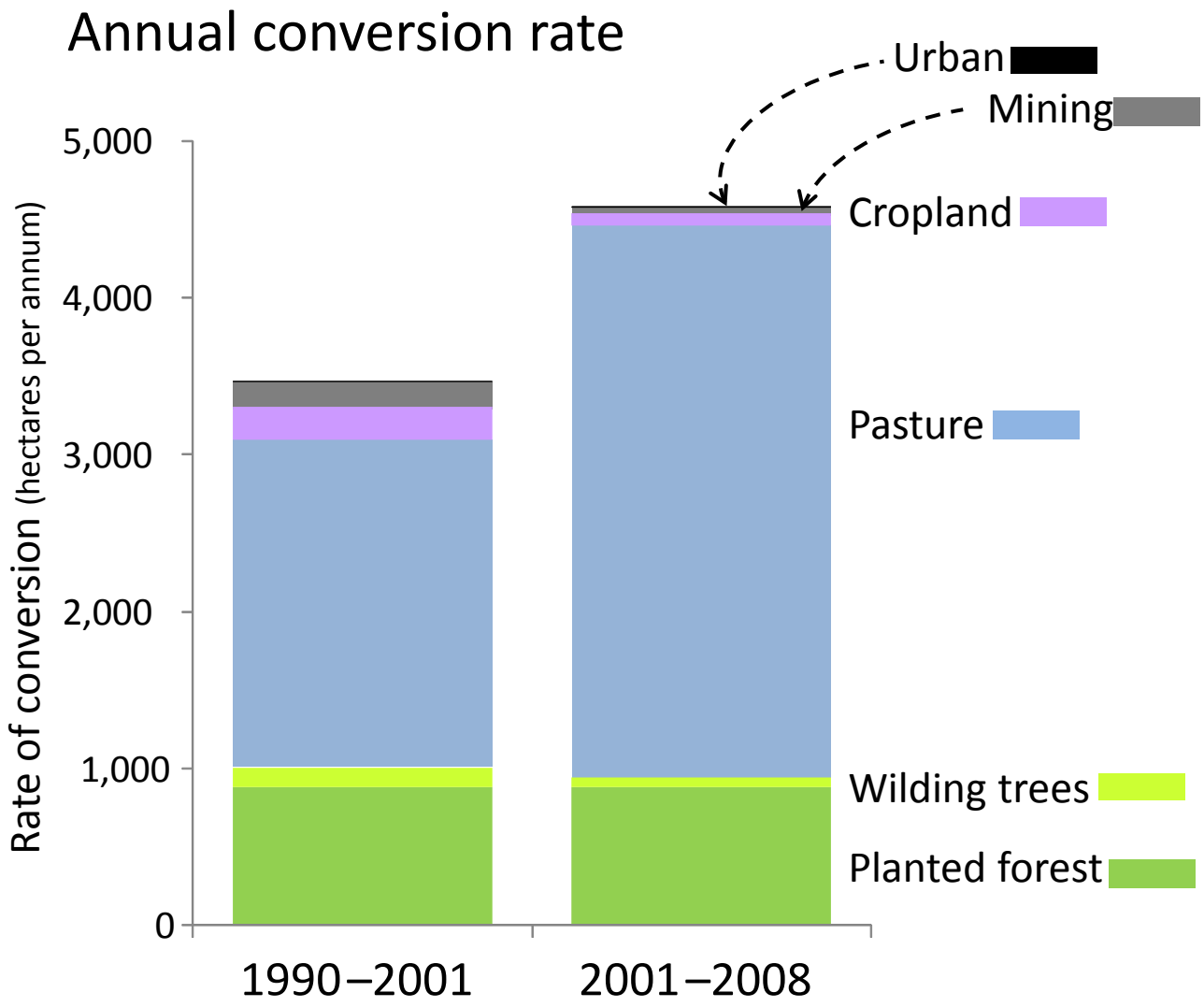


Cieraad, Walker, Price & Barringer 2015. An updated assessment of indigenous cover remaining and legal protection in New Zealand's land environments. New Zealand Journal of Ecology in press.

Indigenous grassland loss rate increasing

Indigenous grassland loss rate increasing

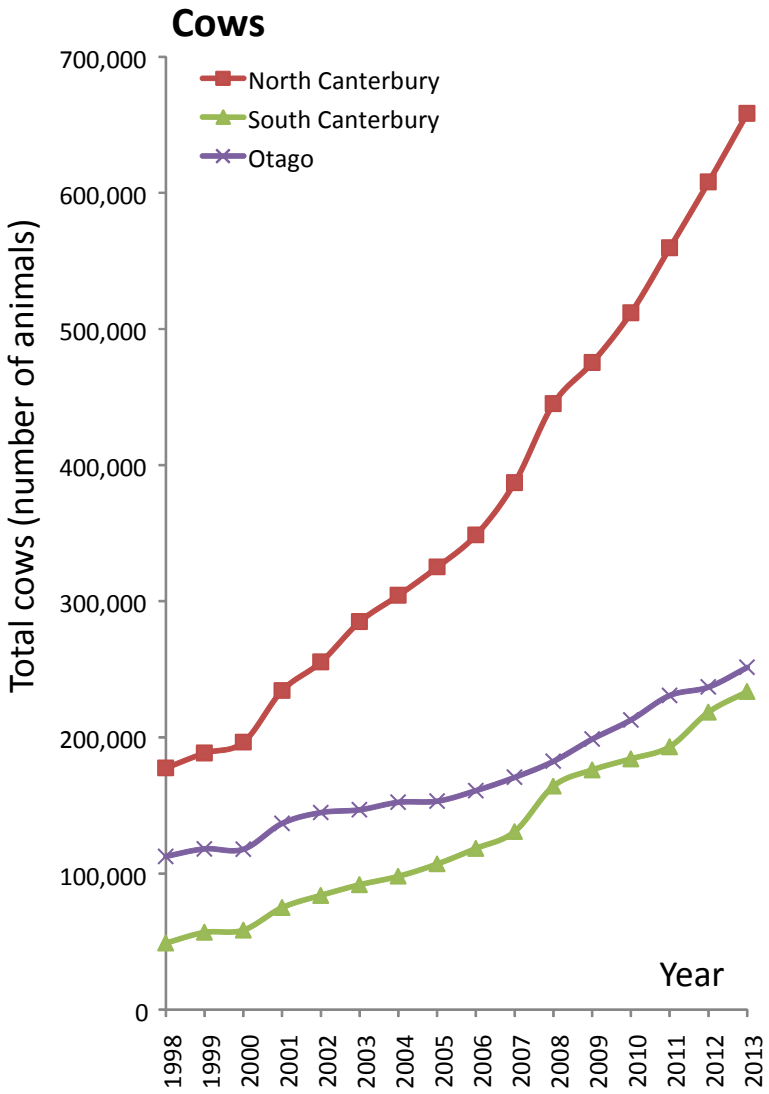


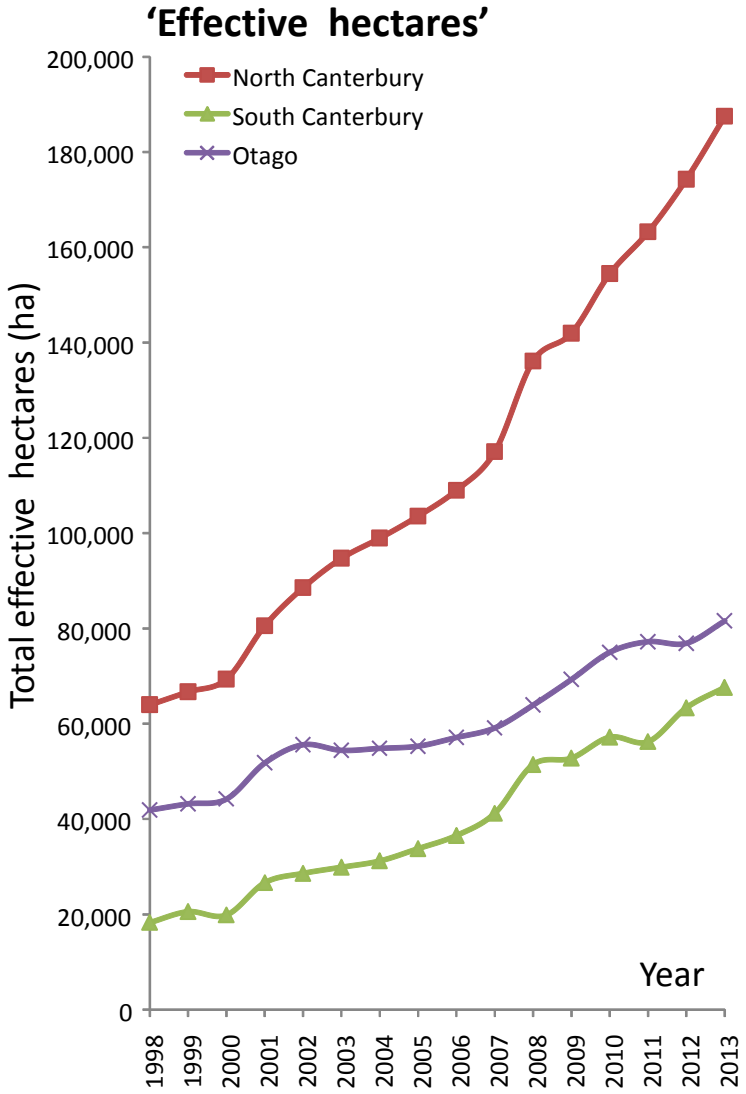


Weeks et al. 2013. Past and recent conversion of indigenous grasslands in the South Island. New Zealand Journal of Ecology 30: 127–138

Primary driver of conversion

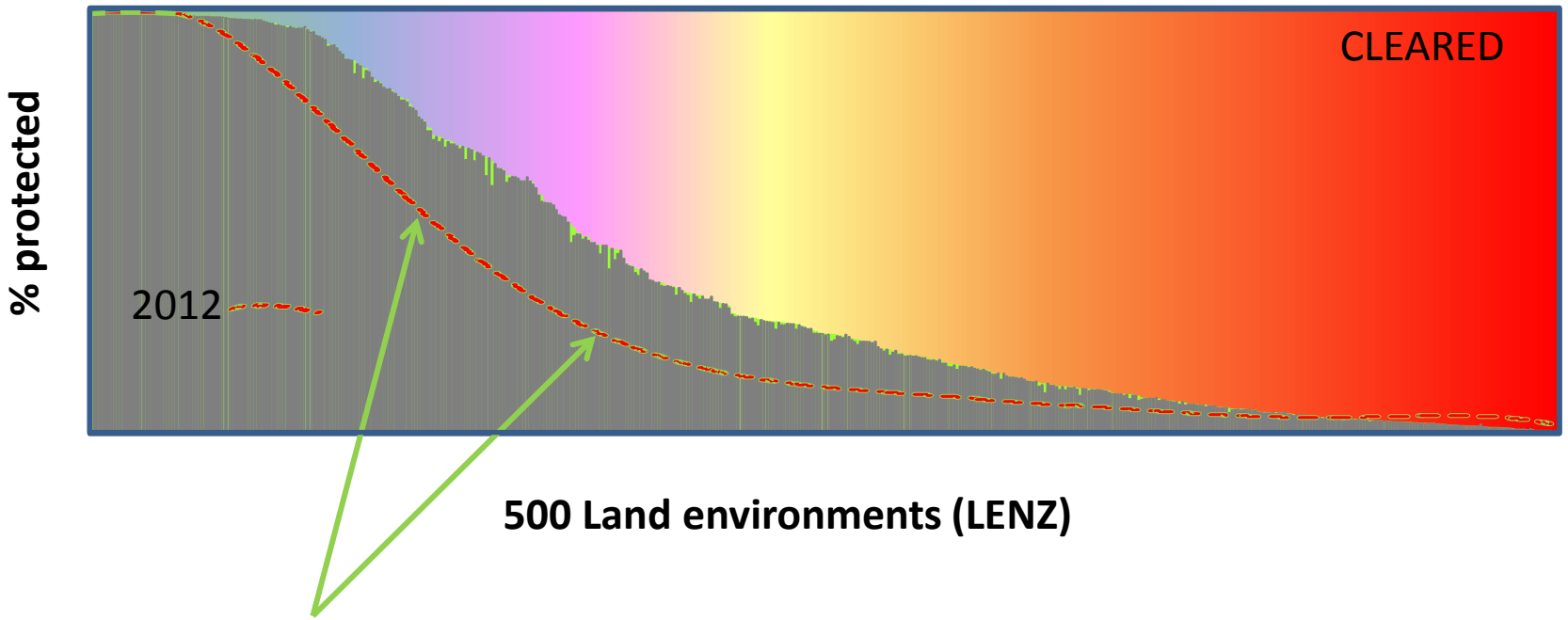
More cows = more land





Published statistics from LIC/Dairy NZ: New Zealand Dairy Statistics Annual Reports

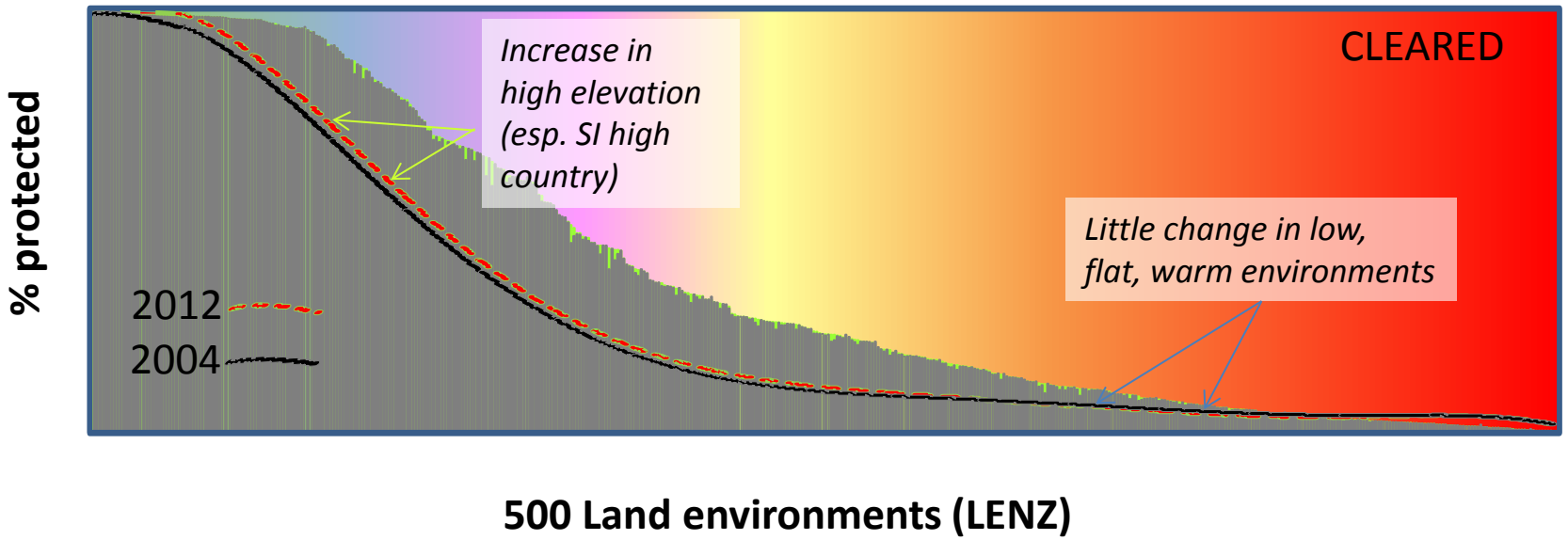
Legal protection across land environments



Legal protection 2012
(>96% DOC, <1% Councils, 2% Nga Whenua Rahui, 1% QEII)

Cieraad, Walker, Price & Barringer 2015. An updated assessment of indigenous cover remaining and legal protection in New Zealand's land environments. New Zealand Journal of Ecology in press

Legal protection across land environments

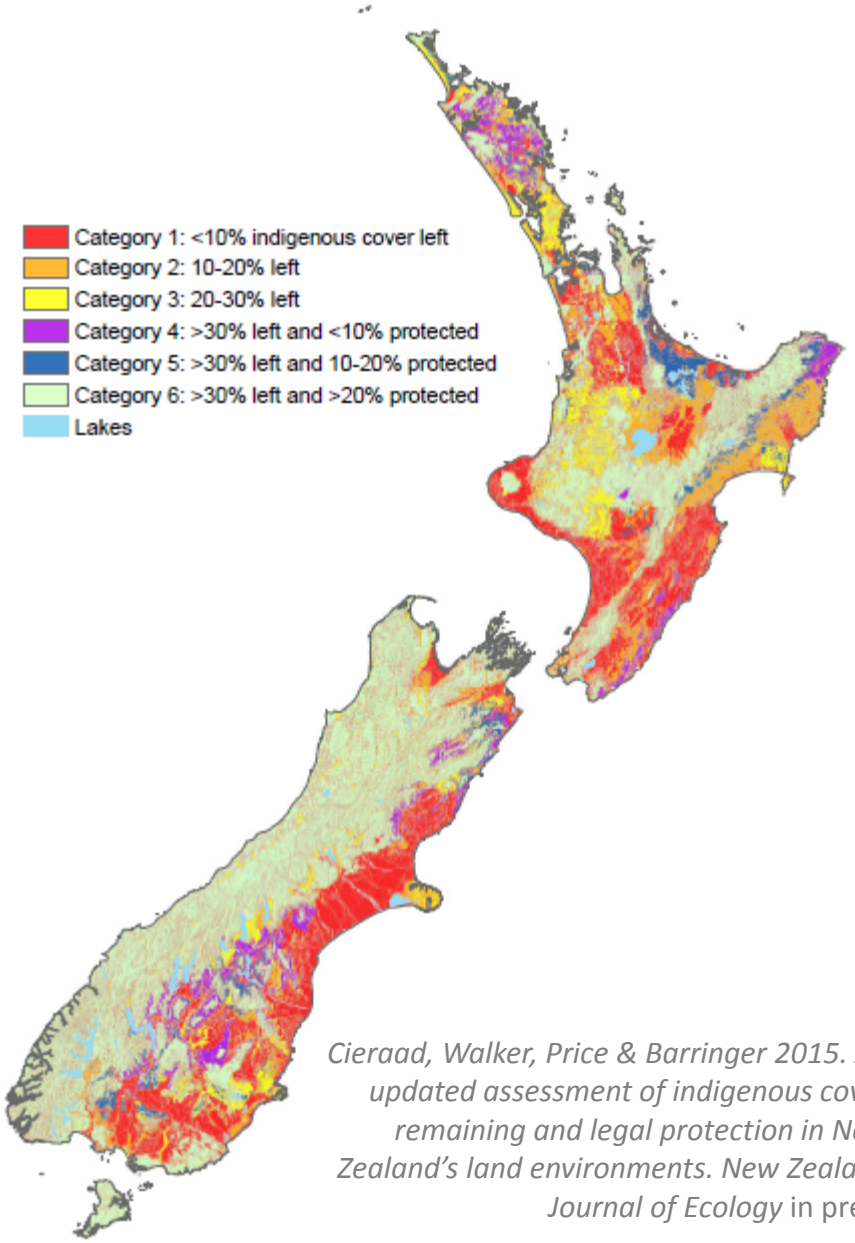


Cieraad, Walker, Price & Barringer 2015. An updated assessment of indigenous cover remaining and legal protection in New Zealand's land environments. New Zealand Journal of Ecology in press

Status of land environments

"… a number of lowland and montane environments have less indigenous vegetation and protection than was previously estimated"

(a) The updated threatened environment classification ('TEC 2012'



Cieraad, Walker, Price & Barringer 2015. An updated assessment of indigenous cover remaining and legal protection in New Zealand's land environments. New Zealand Journal of Ecology in press

Status of naturally uncommon ecosystems

Status of naturally uncommon ecosystems

Inland saline habitat, Central Otago

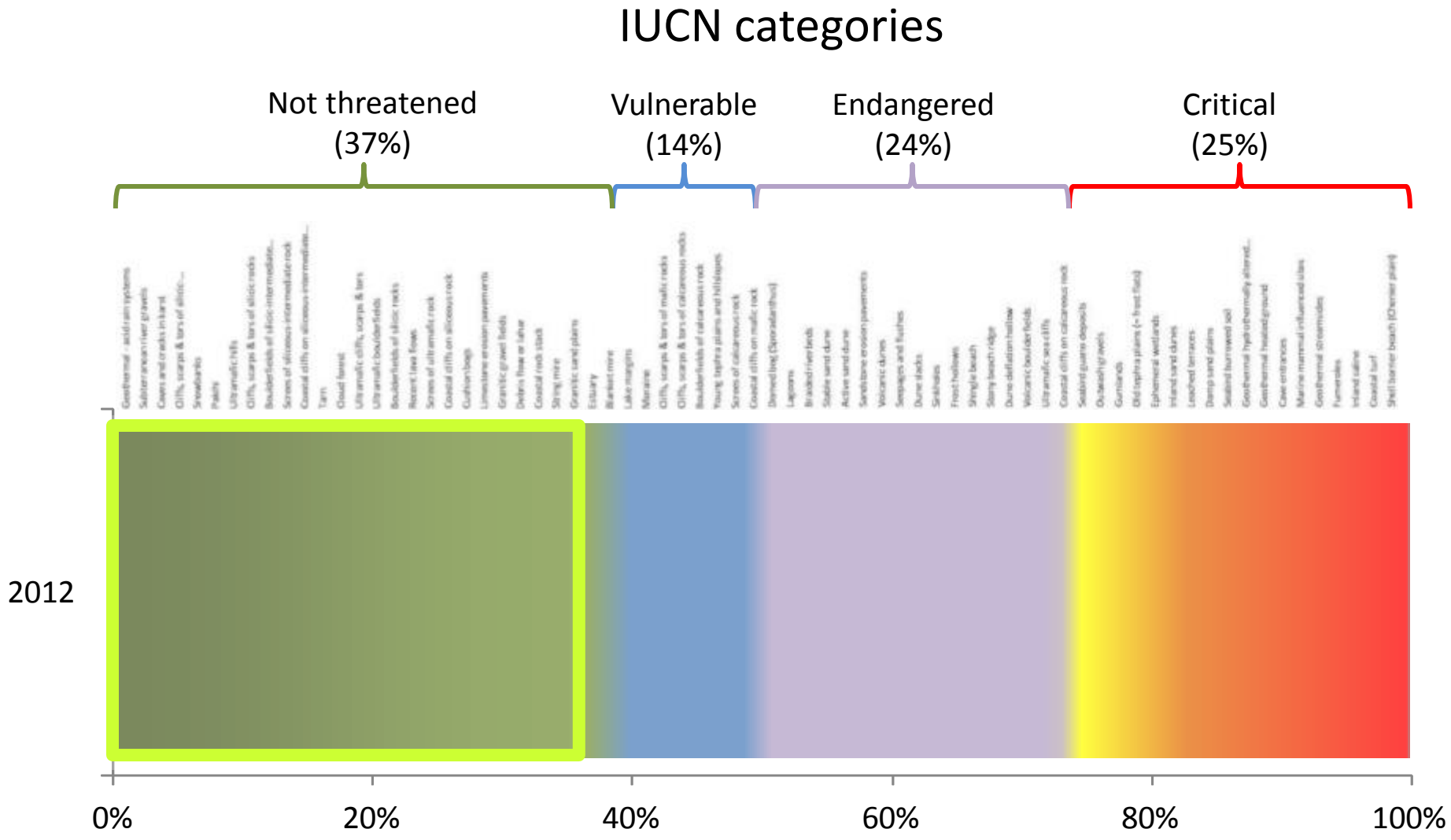
Status of naturally uncommon ecosystems

Ephemeral wetland, Ashburton Basin

Status of naturally uncommon ecosystems

Outwash plain, Upper Waitaki basin

Status of naturally uncommon ecosystems



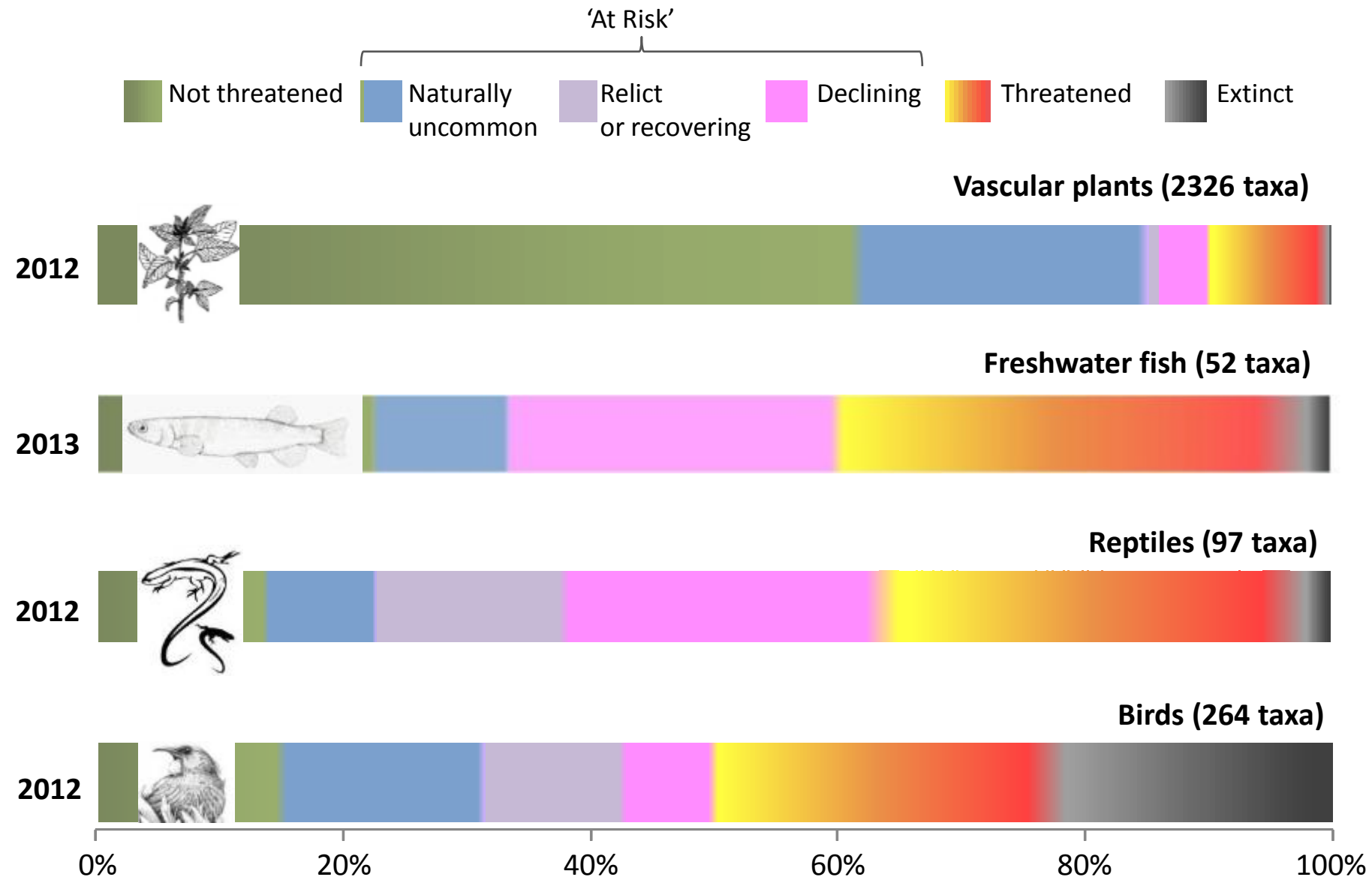
Holdaway et al. 2012. Status assessment of NZ's naturally uncommon ecosystems. Conservation Biology 26: 619–629.

Status of naturally uncommon ecosystems

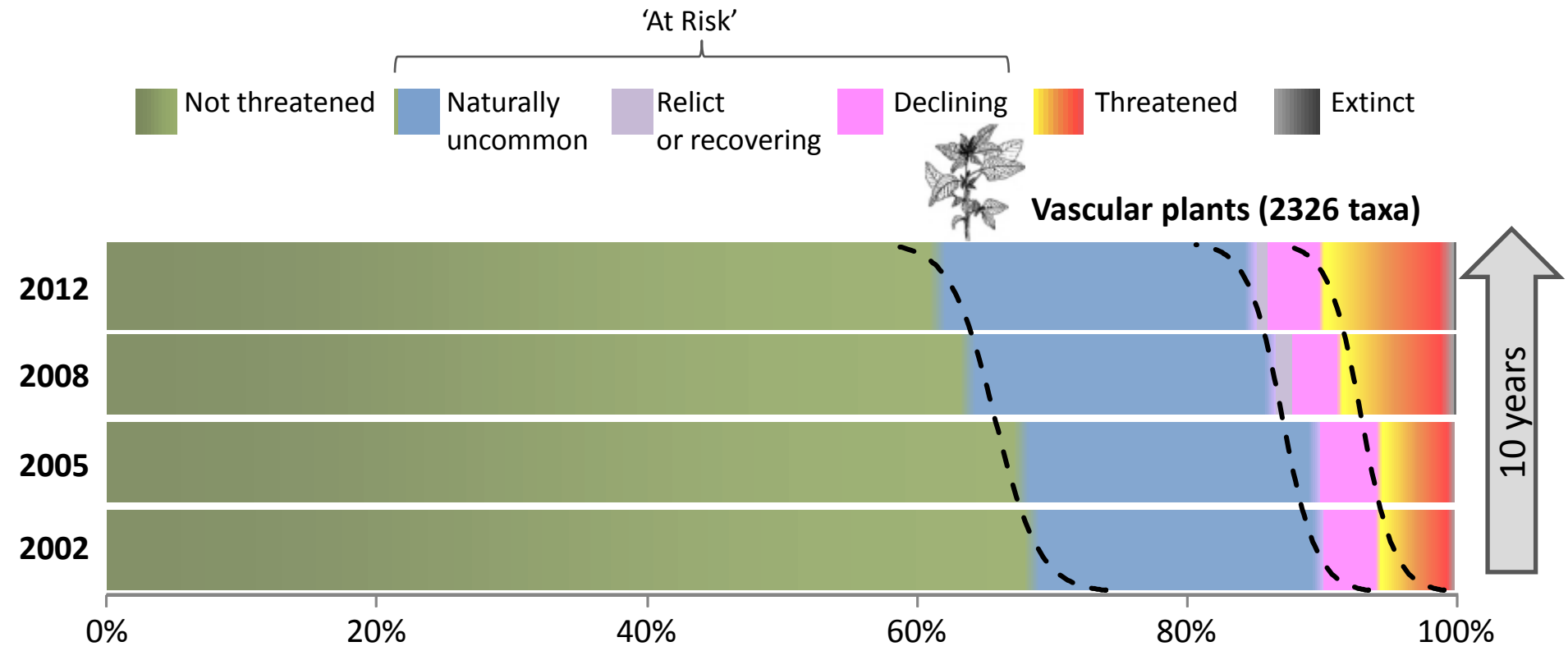
Few are mapped, no formal status monitoring

Status of species

Different biota, different vulnerabilities

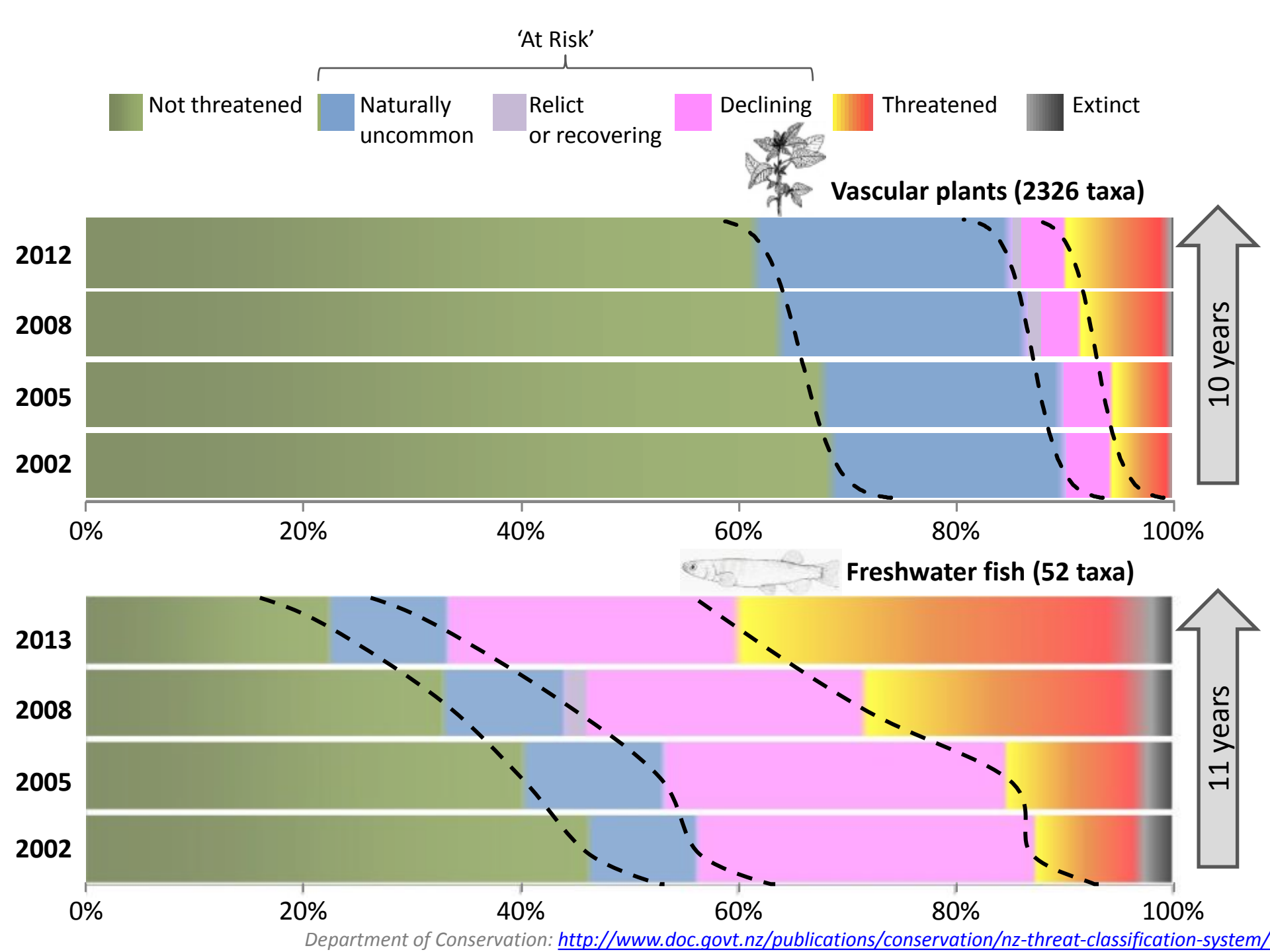


Department of Conservation: http://www.doc.govt.nz/publications/conservation/nz-threat-classification-system/



"…the majority of … new Threatened taxa are genuinely at risk of extinction. Many … restricted to the eastern South Island, especially the intermontane basins …"
(de Lange et al. 2009)

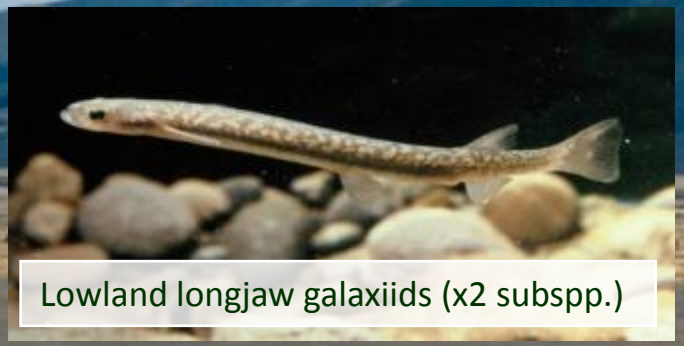
Department of Conservation: http://www.doc.govt.nz/publications/conservation/nz-threat-classification-system/



Department of Conservation: http://www.doc.govt.nz/publications/conservation/nz-threat-classification-system/

Threatened fish endemic to South Island inland basins


Canterbury mudfish


Lowland longjaw galaxiids (x2 subspp.)


Bignose galaxiid


Upland longjaw galaxiid (x2 subspp.)


Flathead, Dusky, Eldon's, Roundhead (x4? subspp.) galaxiids


Shortjaw kokopu


Gollum galaxiid

Goodman et al. 2014. Conservation status of New Zealand freshwater fish, 2013. New Zealand Threat Classification Series 7. 12 p

Declining endemic fish in South Island basins


Torrentfish


Koaro


Inanga

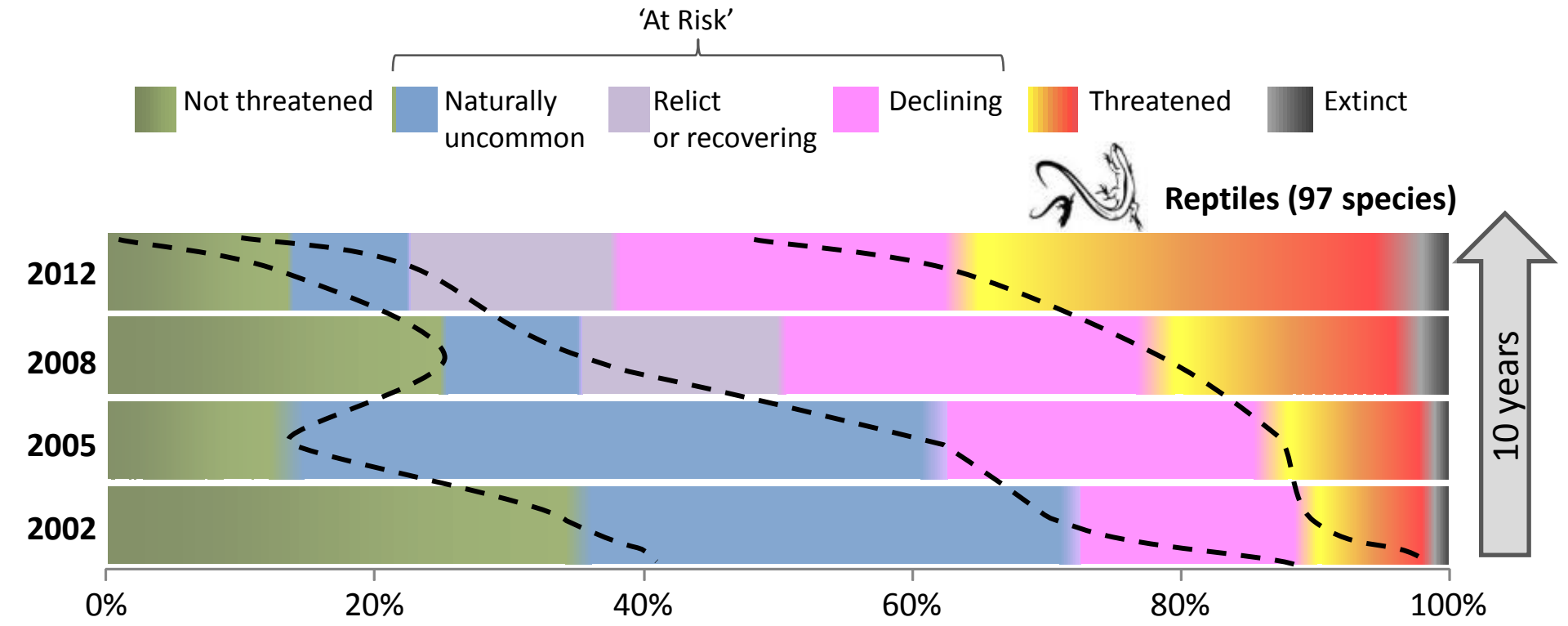

Canterbury galaxiid


Longfin eel


Bluegill bully


Redfin bully

Goodman et al. 2014. Conservation status of New Zealand freshwater fish, 2013. New Zealand Threat Classification Series 7. 12 p



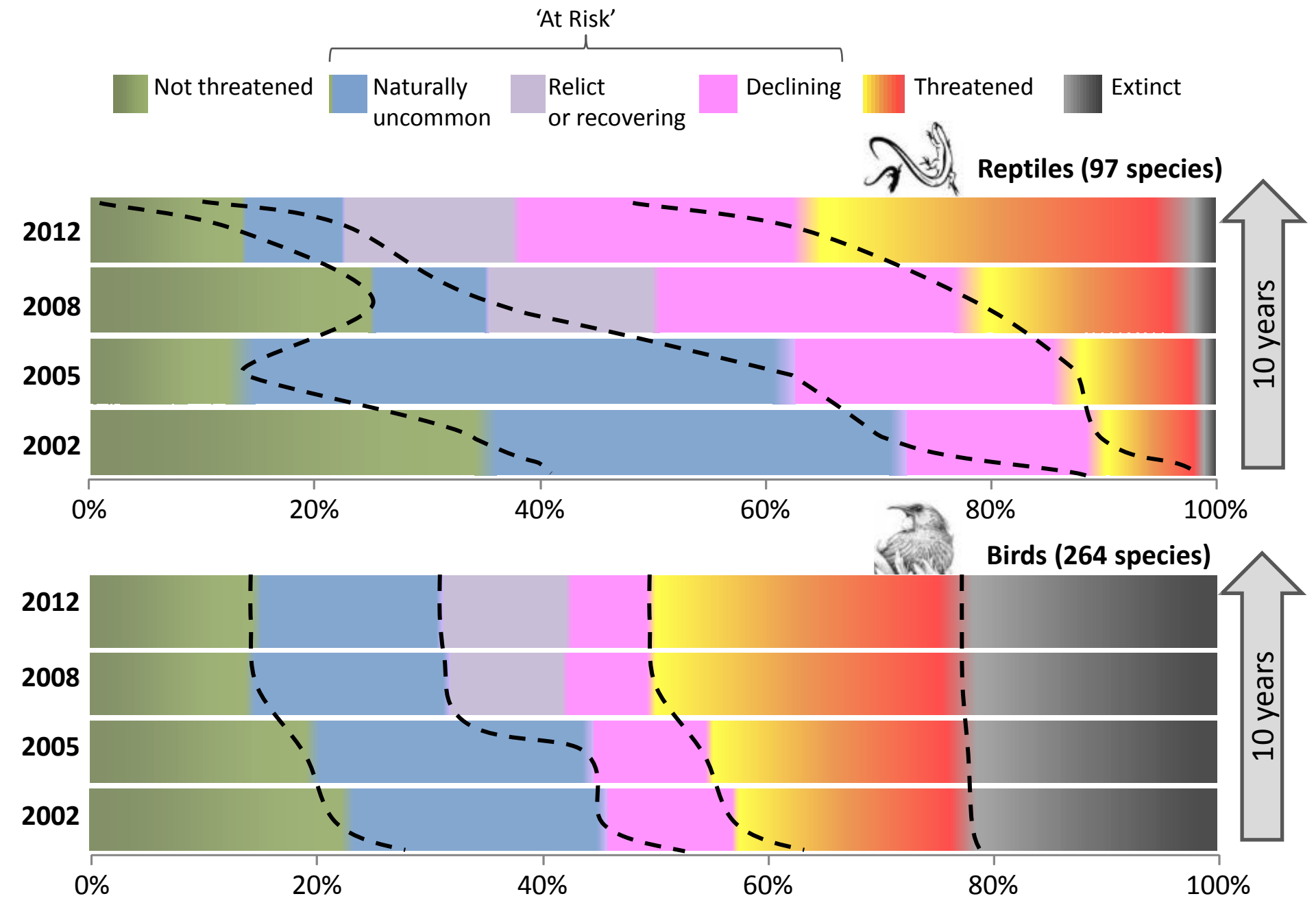
Hitchmough et al. 2013. Conservation status of New Zealand reptiles, 2012. New Zealand Threat Classification Series 2. 16 p
Department of Conservation: http://www.doc.govt.nz/publications/conservation/nz-threat-classification-system/

Canterbury lizard species

Common name	Status 2013	Status 2009
Rangitata skink	Nationally Critical	
Rough gecko	**Nationally Vulnerable**	**Declining**
West Coast green gecko	**Nationally Vulnerable**	**Declining**
Scree skink	**Nationally Vulnerable**	**Declining**
Spotted skink "Mackenzie Basin"	Nationally Vulnerable	
Spotted skink "Central Canterbury"	Nationally Vulnerable	
Large Otago gecko	Declining	
Cryptic skink	**Declining**	**Not Threatened**
Jewelled gecko	Declining	
Canterbury gecko	Declining	
Green skink	Declining	
Southern long-toed skink	Declining	
Common skink clade 4	**Declining**	**Not Threatened**
Common skink clade 5	**Declining**	**Not Threatened**
Marlborough mini gecko	Not Threatened	
Common gecko	Not Threatened	
Southern Alps gecko	Not Threatened	
Pygmy gecko	Not Threatened	
McCann's skink	Not Threatened	

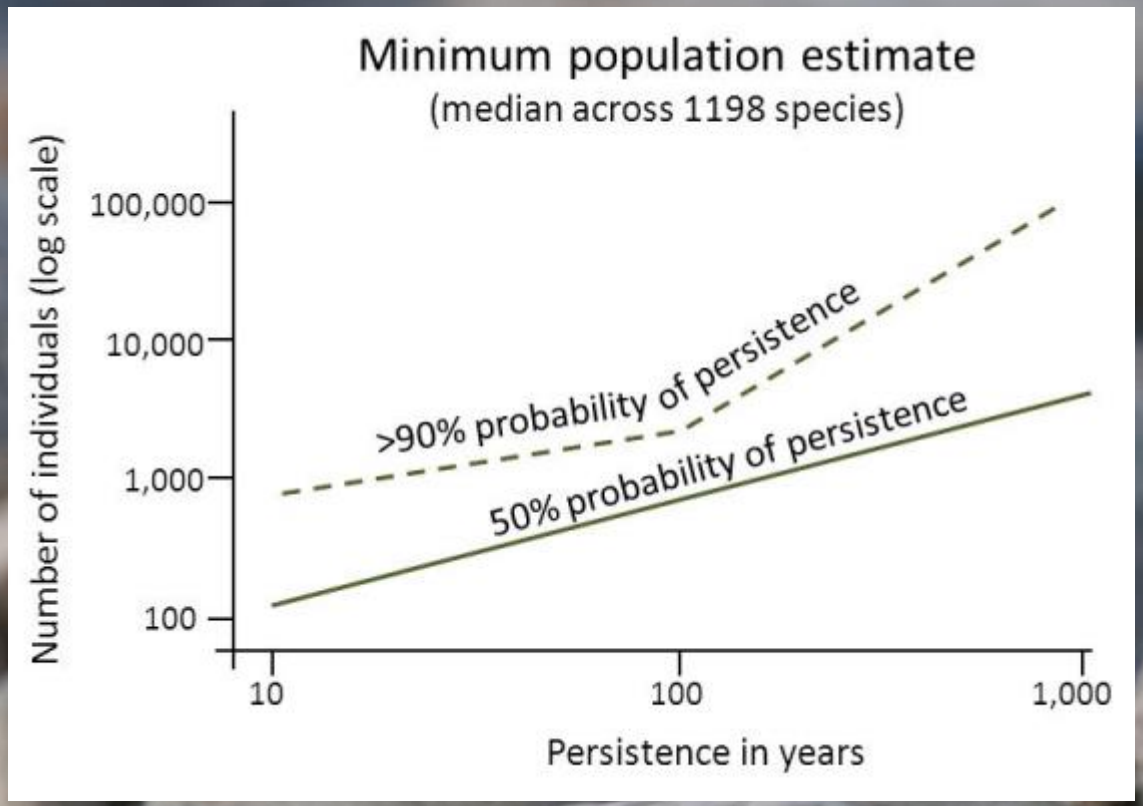
Acknowledgement: Dr Marieke Lettink, Fauna Finders

Hitchmough et al. 2013. Conservation status of New Zealand reptiles, 2012. New Zealand Threat Classification Series 2. 16 p



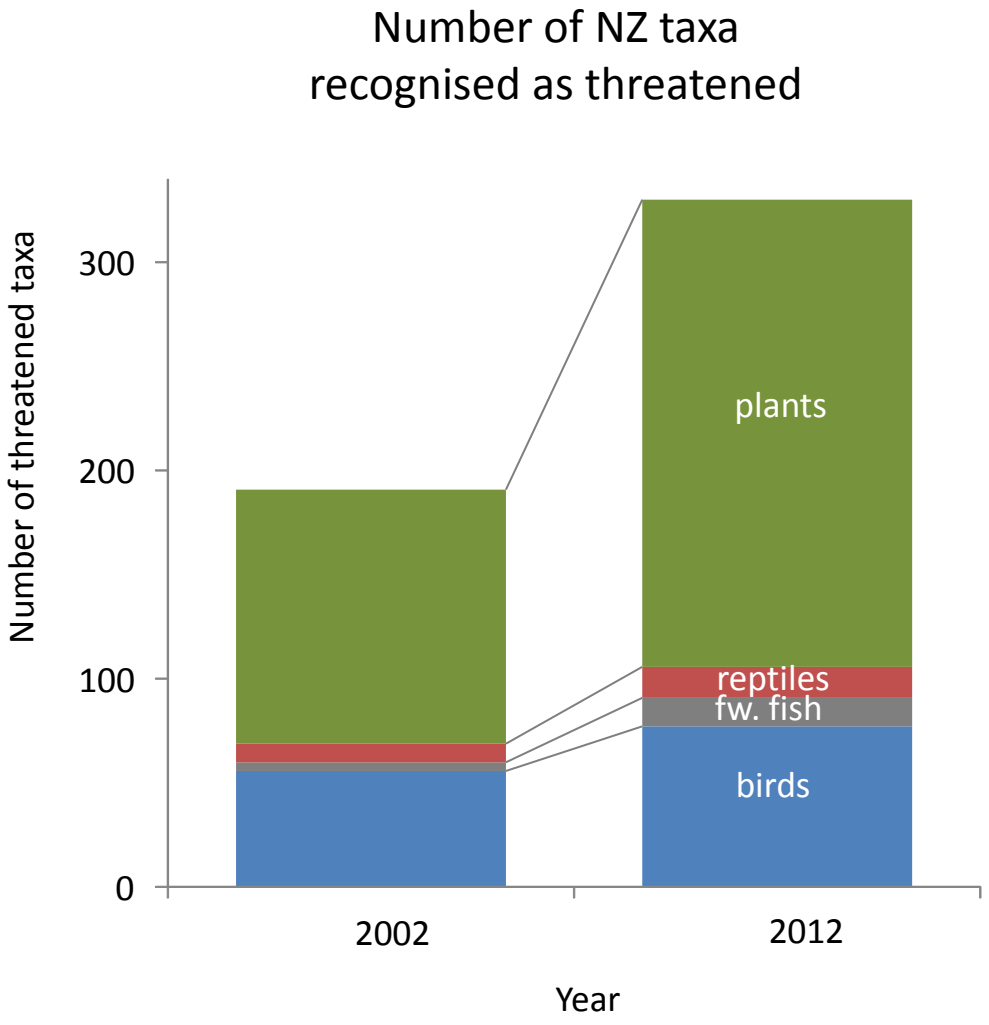
Department of Conservation: http://www.doc.govt.nz/publications/conservation/nz-threat-classification-system/

Implications of low numbers



Traill et al. 2010. Pragmatic conservation targets in a rapidly changing world. Conservation Biology 143: 28–34

Implications of low numbers

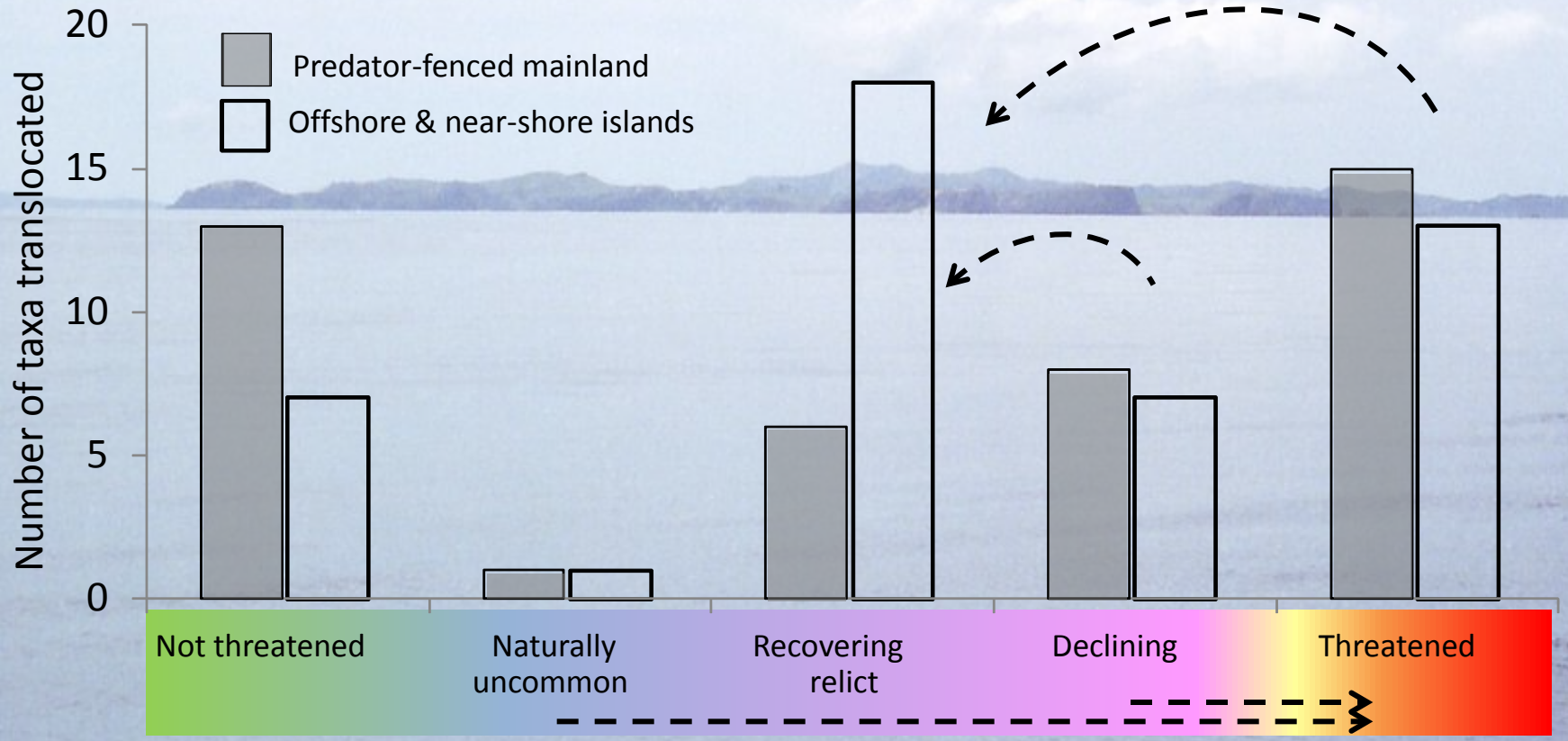


Two areas of progress

1. Stabilisation of some of the most charismatic of New Zealand's threatened species

Stabilisation of some threatened species

Number of taxa translocated
to 2010 (of weta, amphibians, reptiles, & birds)

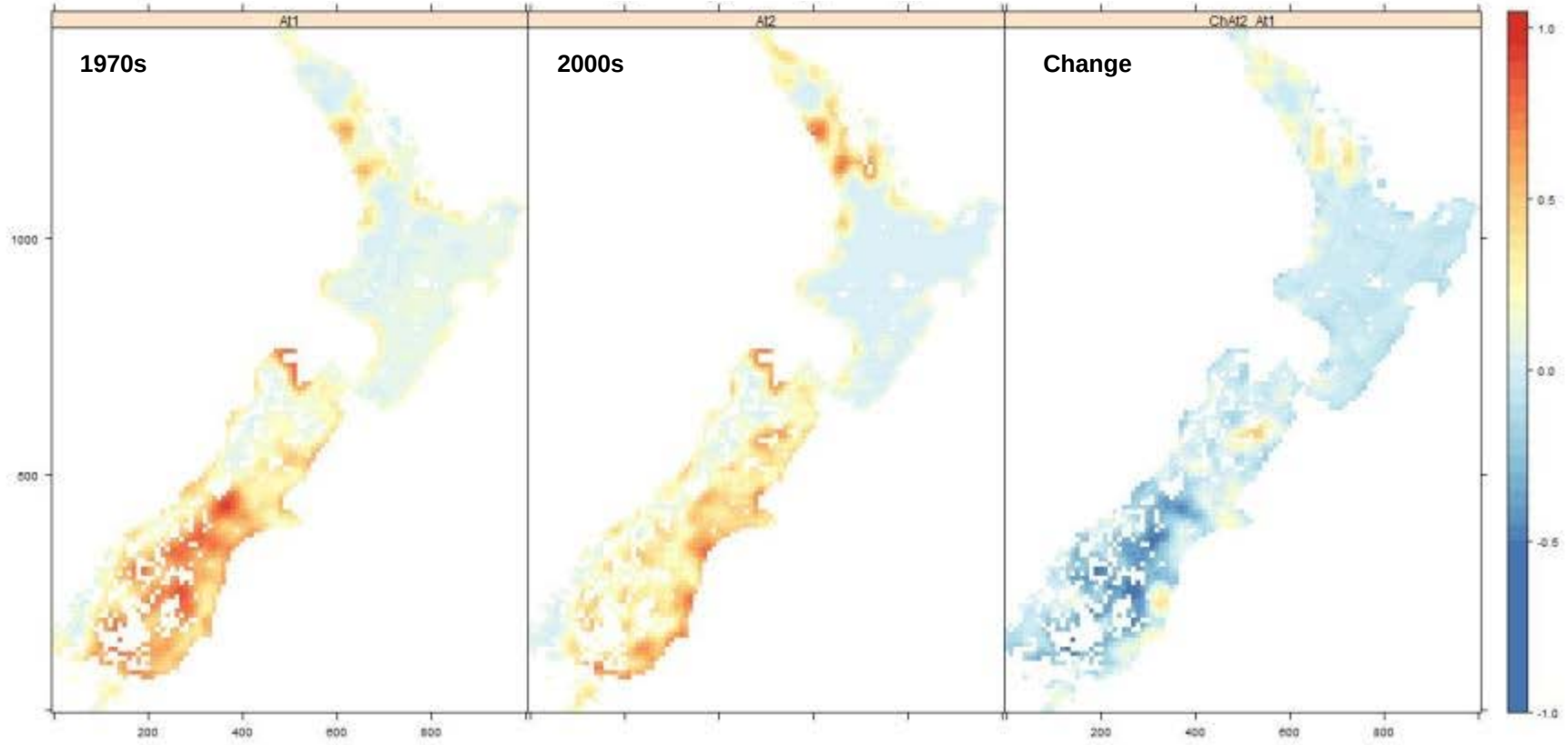


Burns et al. 2009. In: ***Fencing for conservation****. New York, Springer. Pp.*
Bellingham et al. 2010. ***Island restoration.*** *New Zealand Journal of Ecology 34: 11*
Kelly & Sullivan 2010. ***Progress and prospects in NZ ecology.*** *New Zealand Journal of Ecology 34: 20*

Native waders

Occupancy

South Island pied oystercatcher (Declining)

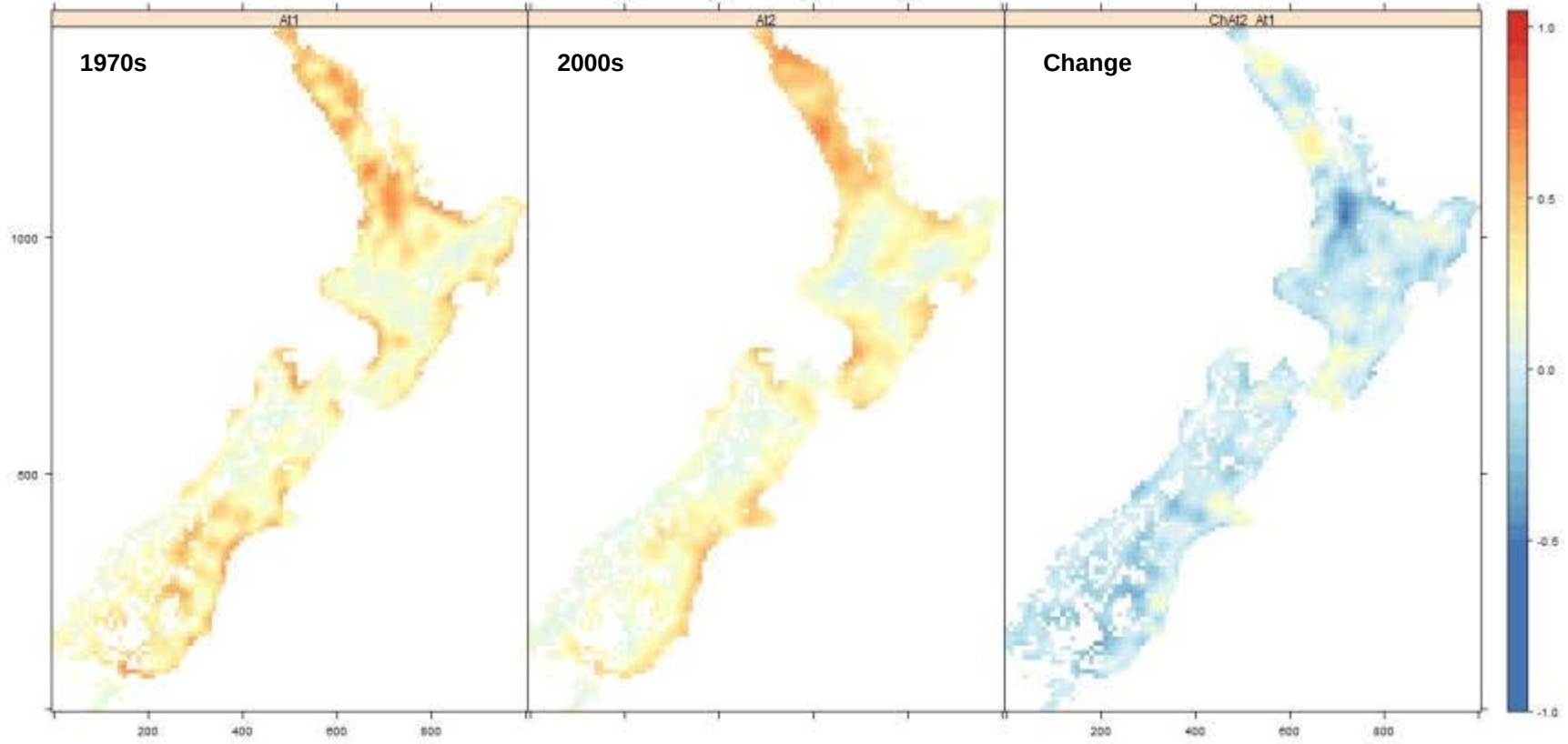


Walker and Monks in prep.
based on Ornithological Society of New Zealand data
in Bull et al. 1985 and Robertson et al. 2007

Native waders

Occupancy

Pied stilt (Declining)



Walker and Monks in prep.
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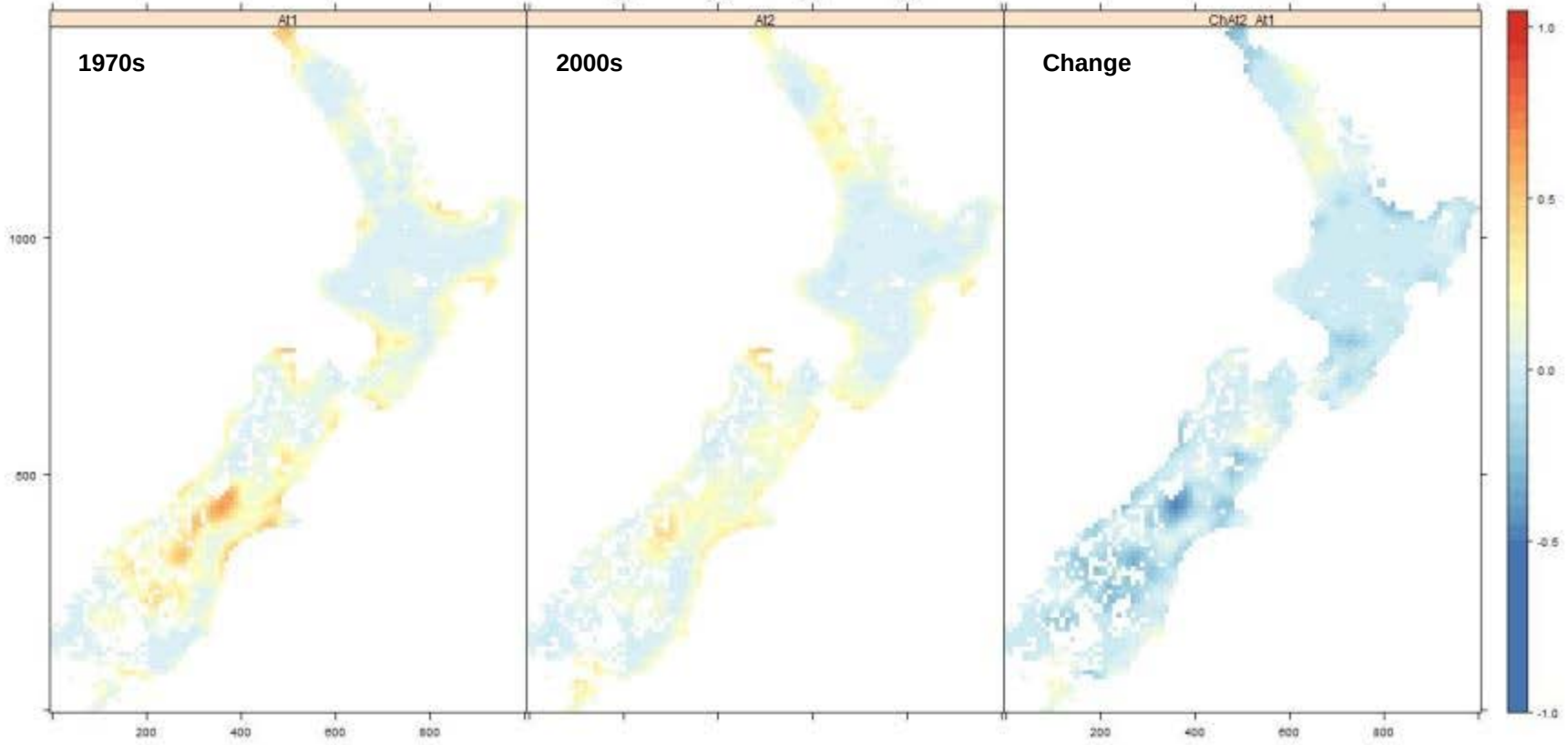
in Bull et al. 1985 and Robertson et al. 2007

Native waders

Occupancy

Banded dotterel (Nationally Vulnerable)

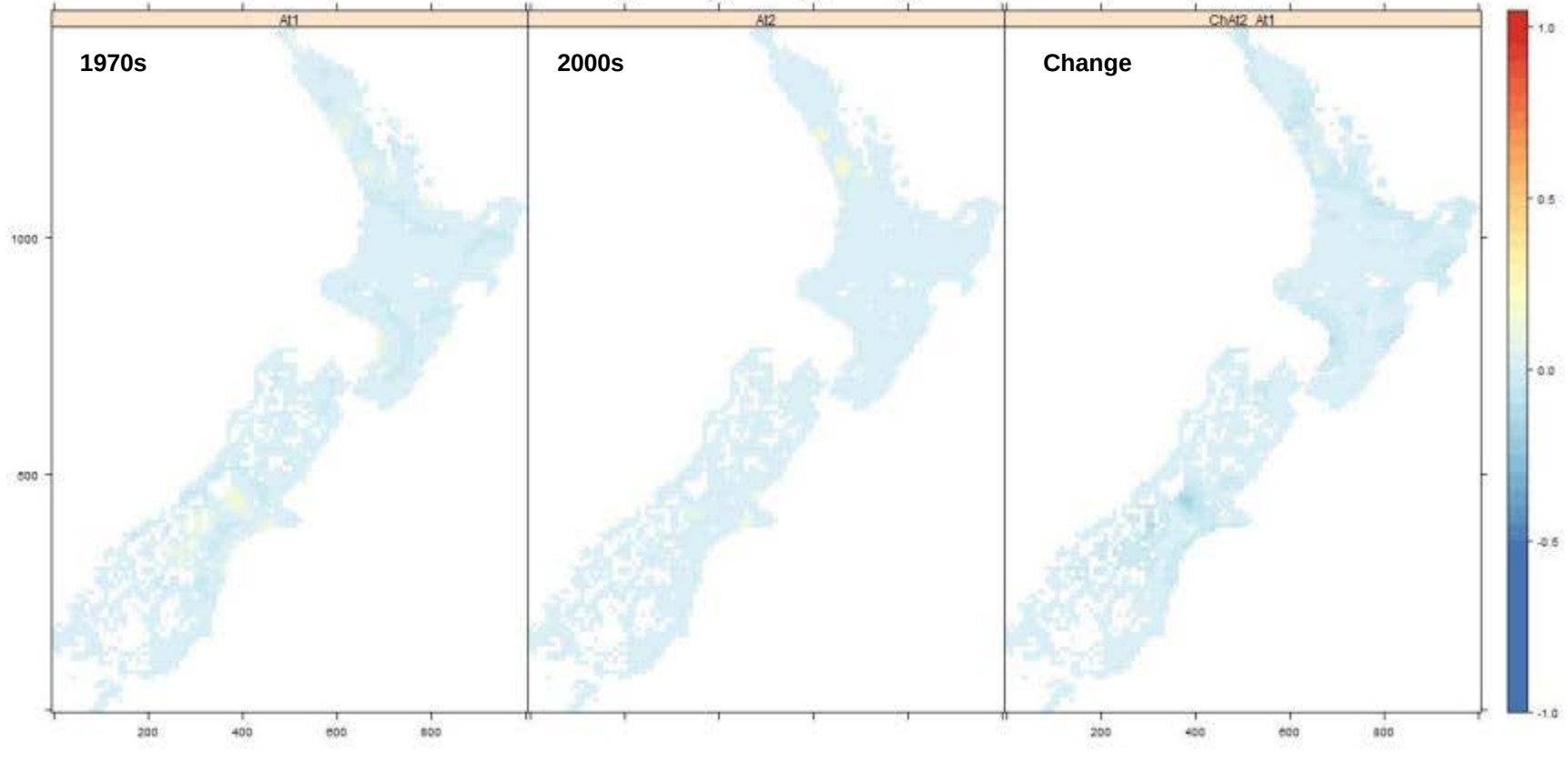


Walker and Monks in prep.
based on Ornithological Society of New Zealand data
in Bull et al. 1985 and Robertson et al. 2007

Native waders

Occupancy

Wrybill (Nationally Vulnerable)

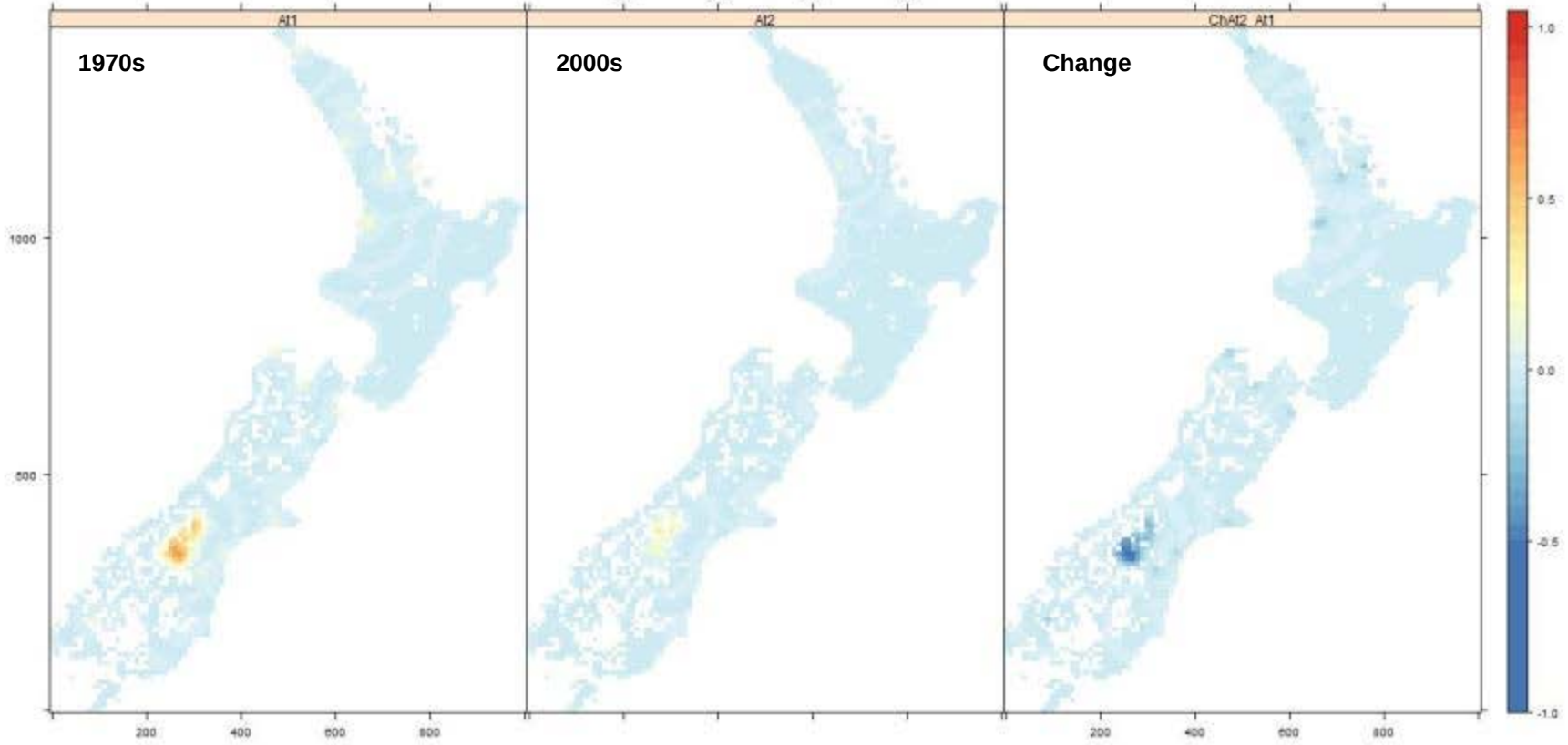


Walker and Monks in prep.
based on Ornithological Society of New Zealand data
in Bull et al. 1985 and Robertson et al. 2007

Native waders

Occupancy

Black stilt (Nationally Critical)

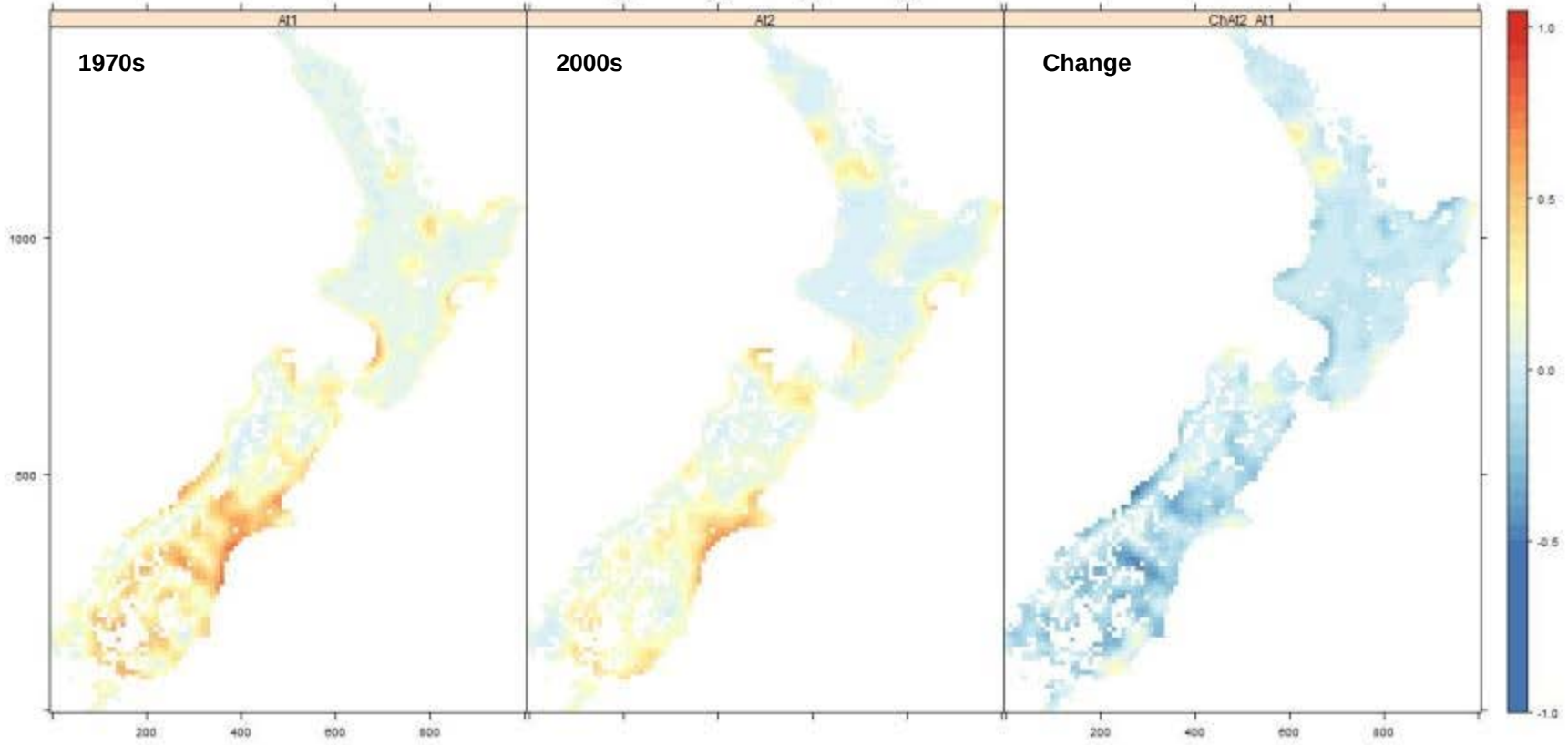


Walker and Monks in prep.
based on Ornithological Society of New Zealand data
in Bull et al. 1985 and Robertson et al. 2007

Terns and gulls

Occupancy

Black-billed gull (Nationally Critical)

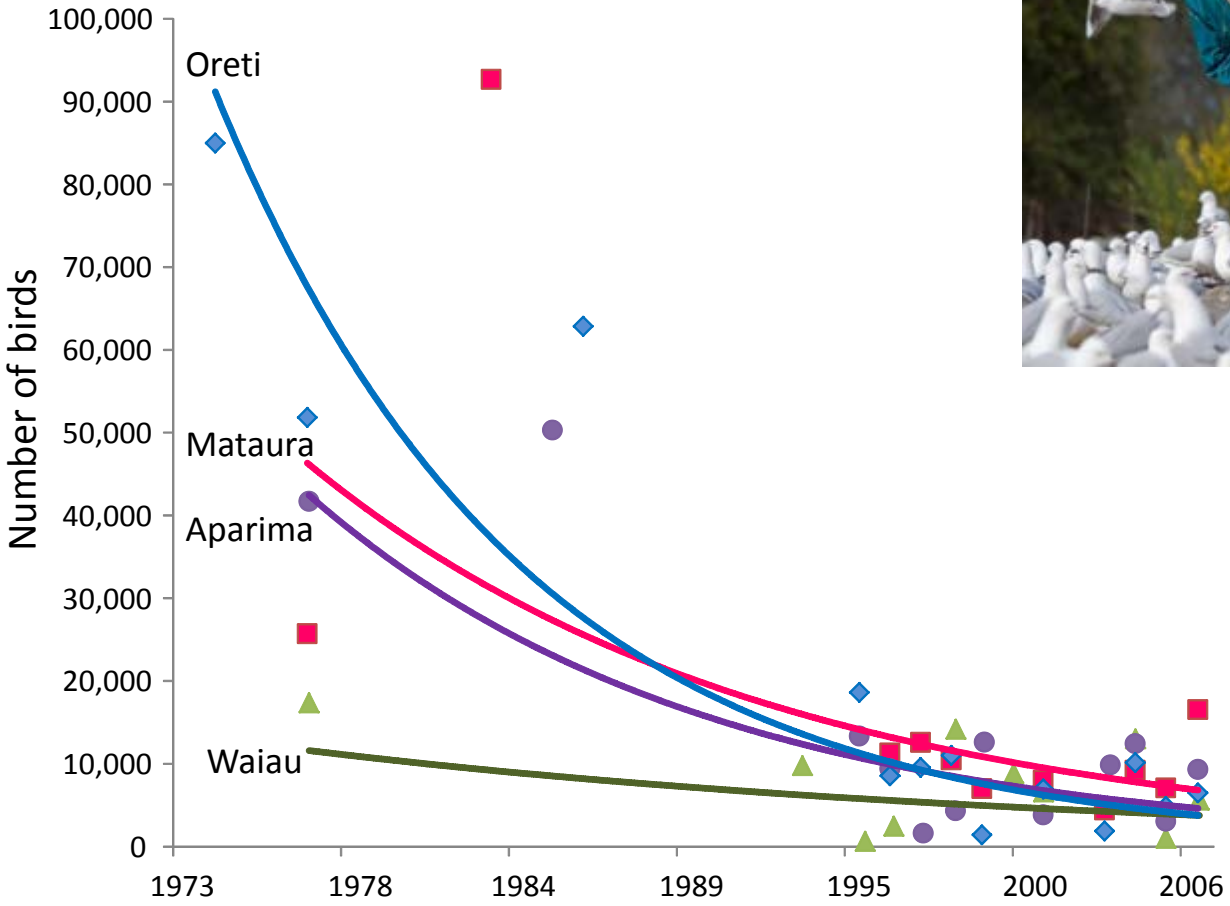


Walker and Monks in prep.
based on Ornithological Society of New Zealand data
in Bull et al. 1985 and Robertson et al. 2007

Terns and gulls

Black-billed gull (Nationally Critical)

on four Southland rivers



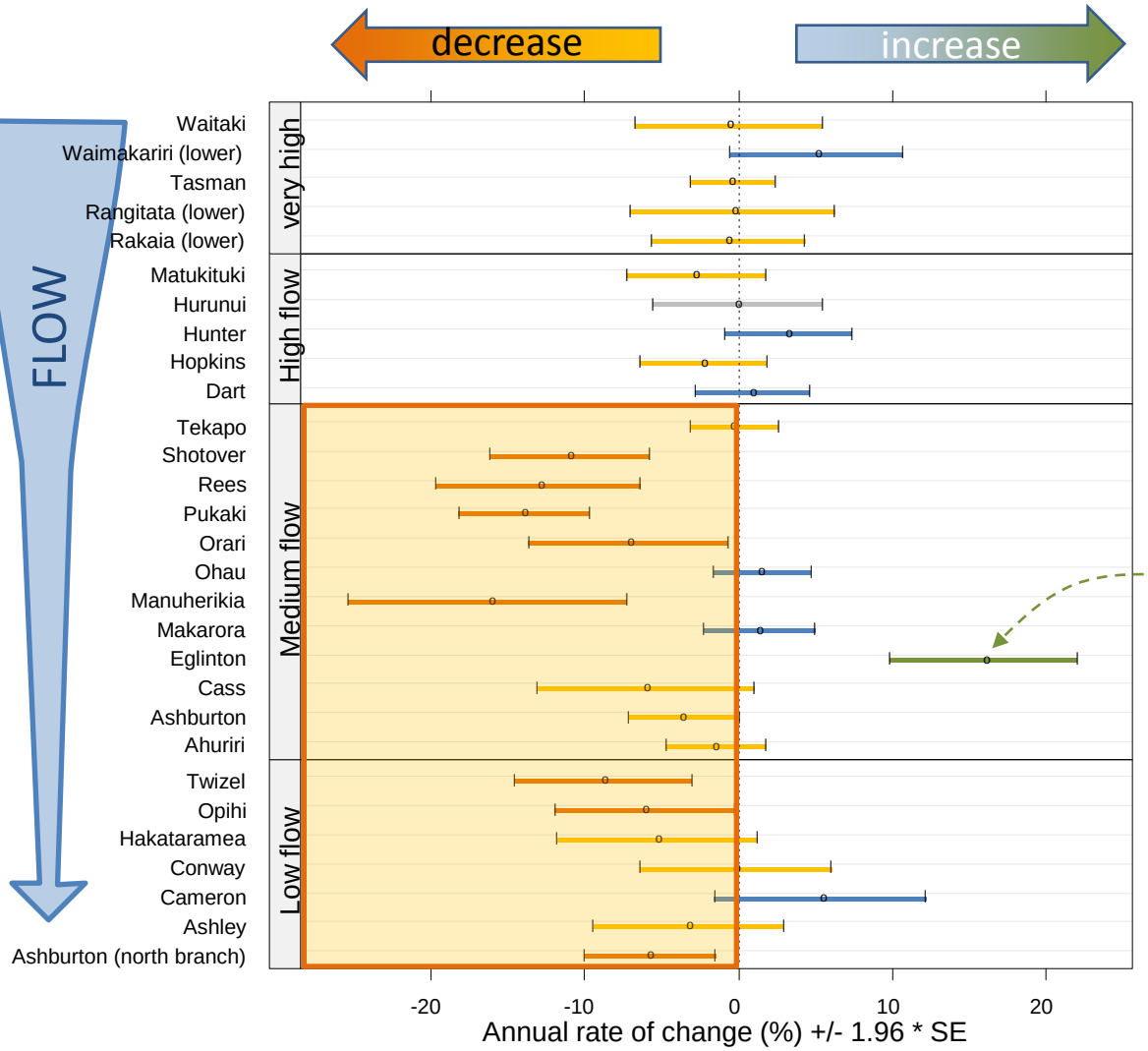
Counts
1977 – 2007
Declining 6% p.a
(84% over 30 years)

McLellan 2008.The ecology and management of Southland's black billed gulls. PhD thesis, University of Otago

Terns and gulls

Black-fronted terns (Nationally Endangered)

29 South Island rivers



Counts repeated at monitoring sites 4 – 18 times, 1962 – 2008

8 significant decreases

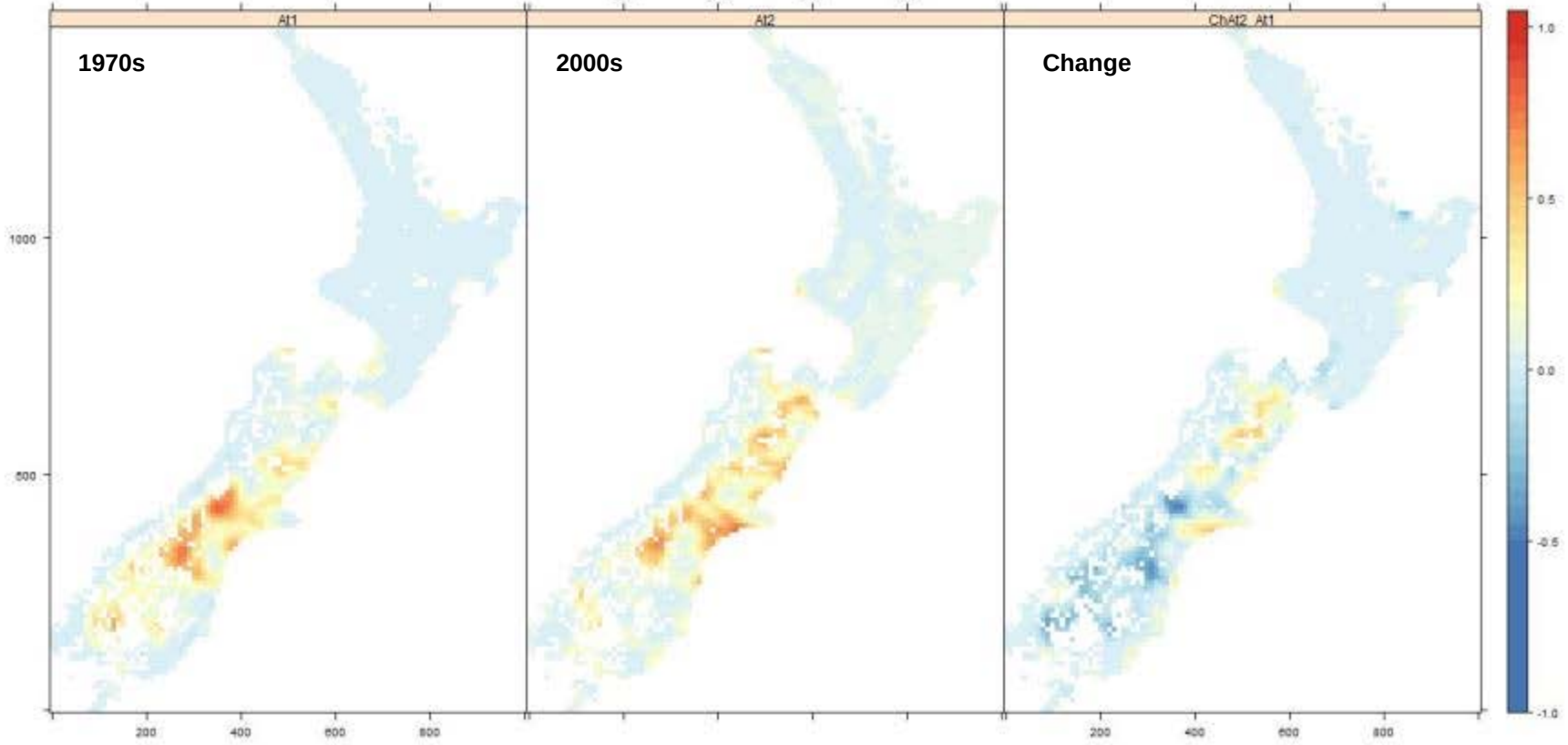
only site with sustained predator control (aimed at mustelids)

O'Donnell & Hoare 2011. Population trends in black-fronted terns. New Zealand Journal of Ecology 35: 30–43

Terns and gulls

Occupancy

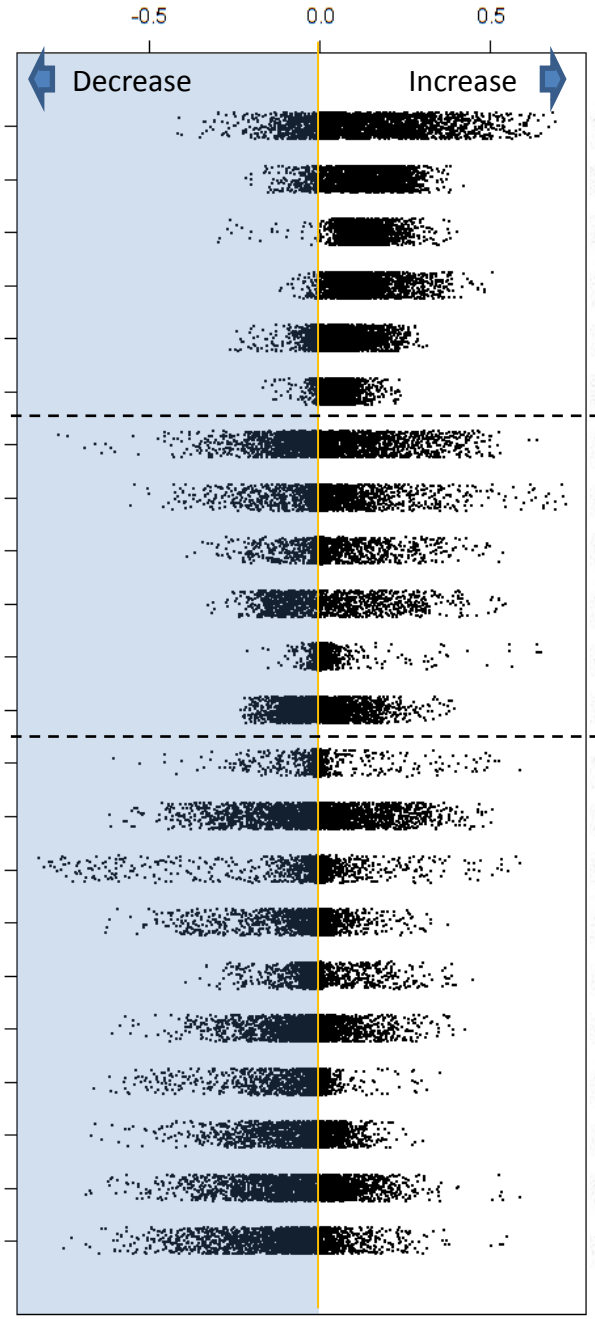
Black-fronted tern (Nationally Endangered)



Walker and Monks in prep.
based on Ornithological Society of New Zealand data
in Bull et al. 1985 and Robertson et al. 2007

Forest and alpine birds

Change in occupancy 1970s to 2000s



Increased in most places

Increased in some places, decreased in others

Decreased in most places

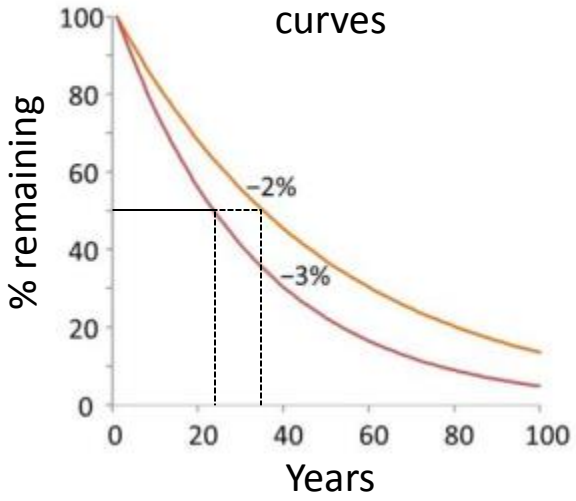
Walker and Monks in prep.

Bull et al. 1985. The atlas of bird distribution in New Zealand. Wellington, New Zealand, ***The Ornithological Society of New Zealand***

Robertson et al. 2007. Atlas of bird distribution in New Zealand 1999–2004. Wellington, New Zealand, ***The Ornithological Society of New Zealand***

Remaining extensive kiwi populations

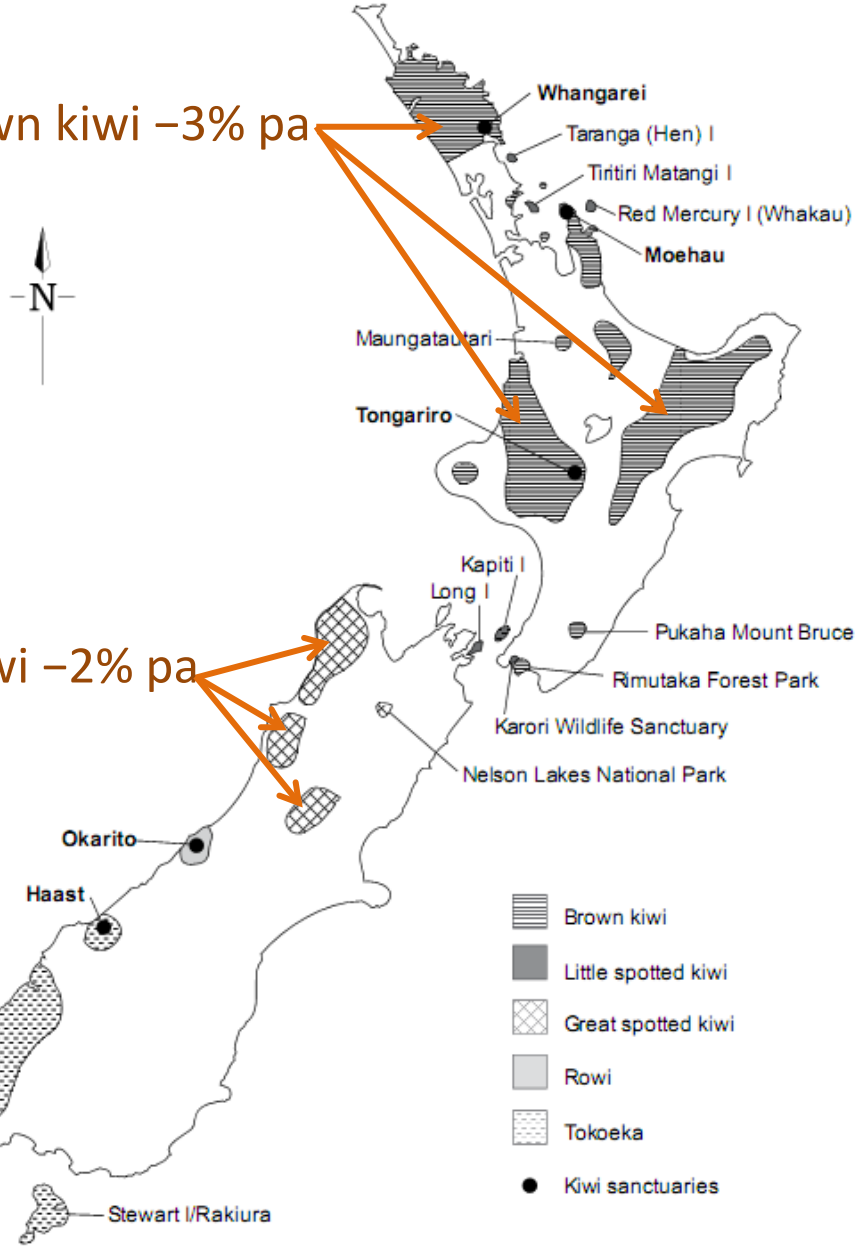
Projected decline curves



Unmanaged Brown kiwi −3% pa

Great spotted kiwi −2% pa

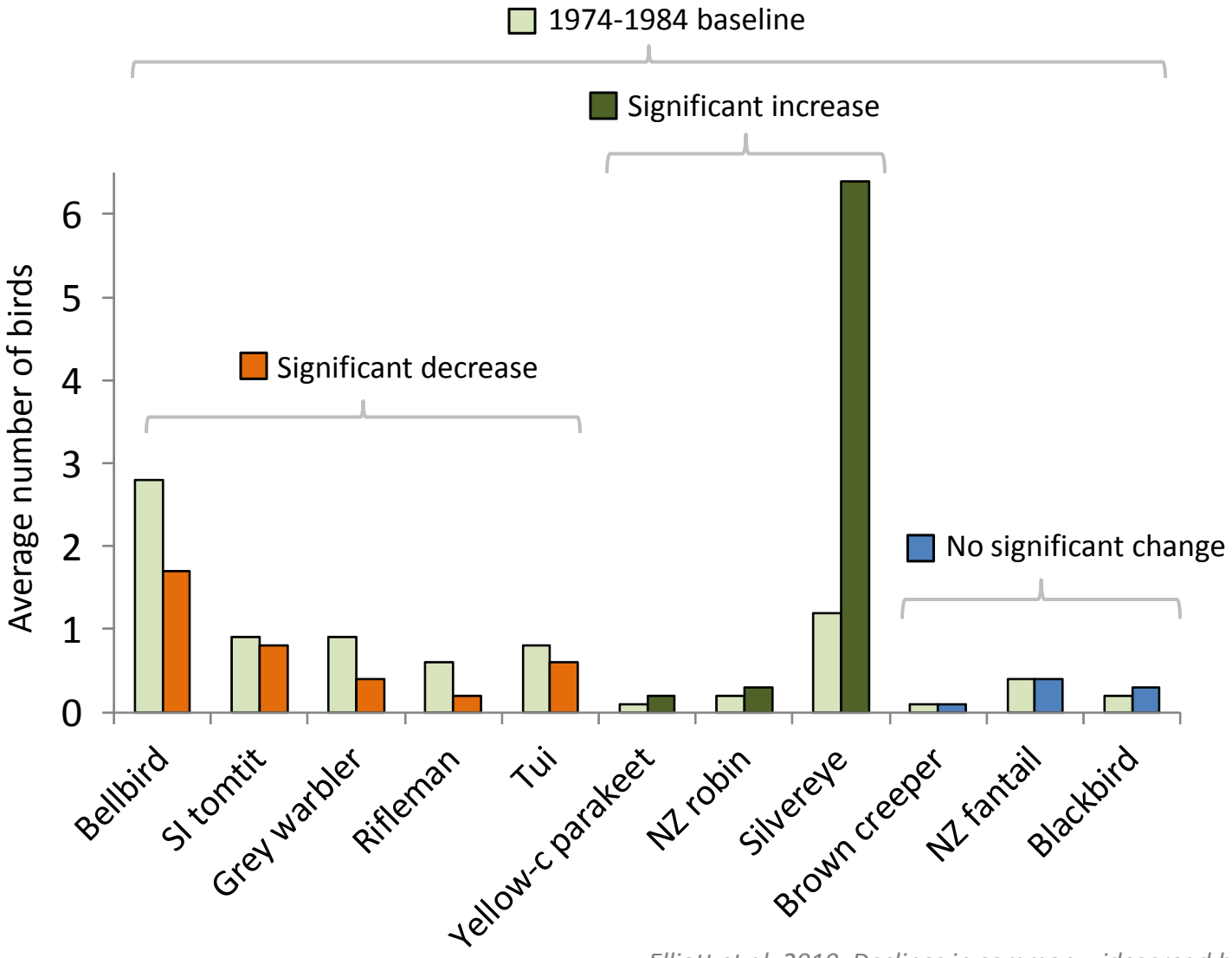
Tokoeka −2% pa



Holzapfel et al. 2008. Kiwi (Apteryx spp.) recovery plan. Threatened Species Recovery Plan 60. Department of Conservation

Changes in common forest birds over 3 decades

with possum and wasp invasion



Mt Misery, Nelson Lakes National Park

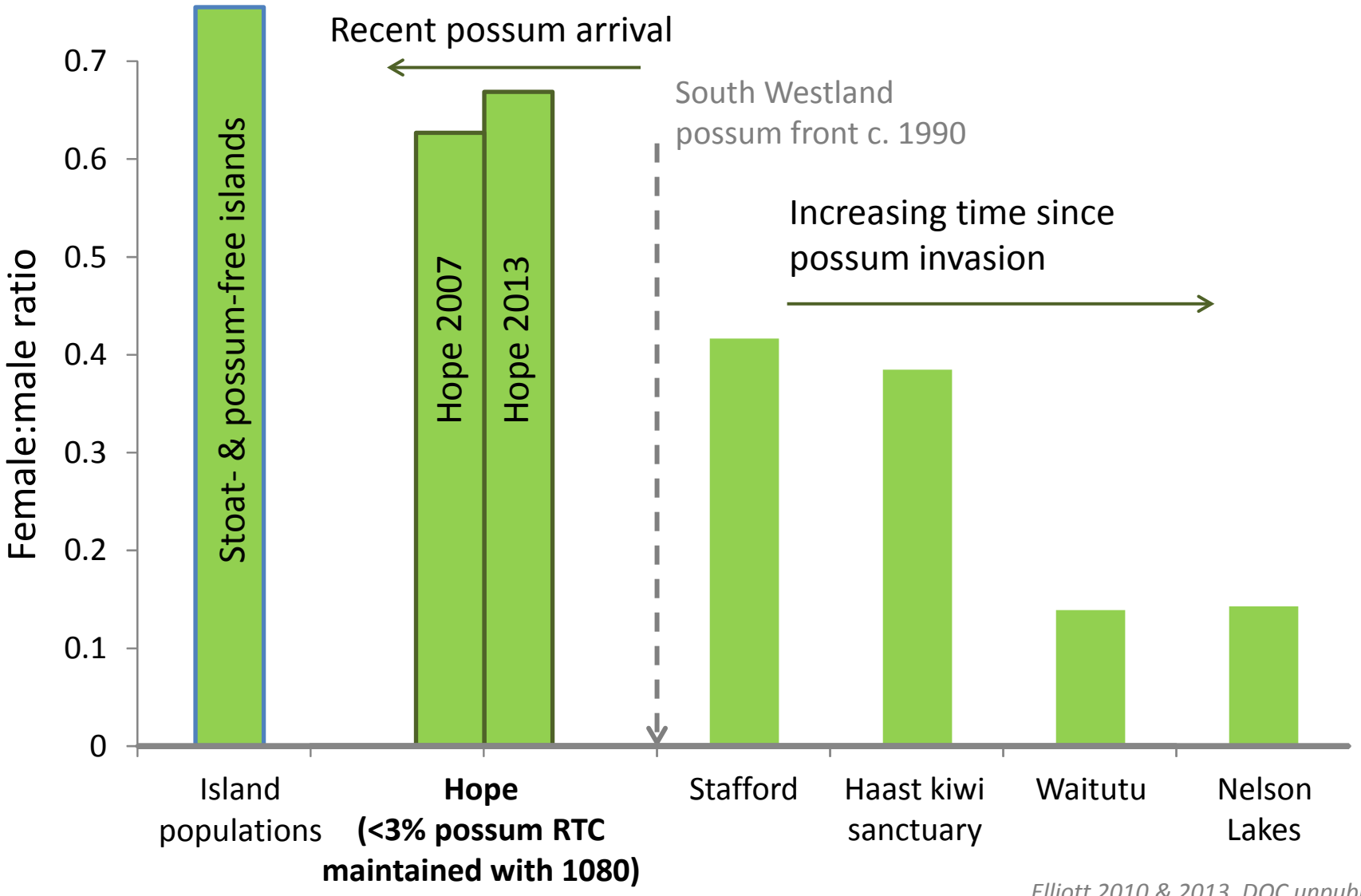
5-minute bird counts, 33 years, 1974 – 2007

Declines not evident above 1000m

Elliott et al. 2010. Declines in common widespread birds in a mature tempoerate forest. Biological Conservation 143: 2119–2126

Kaka sex ratios

Without (left) and with (right) possums

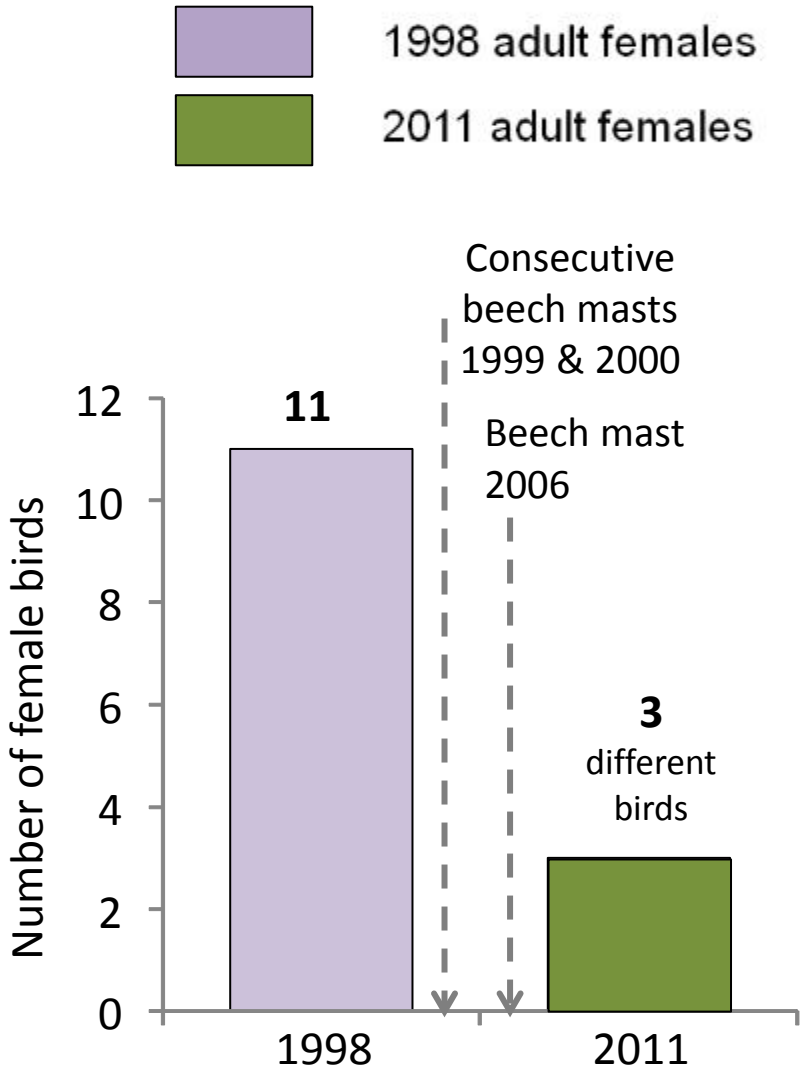


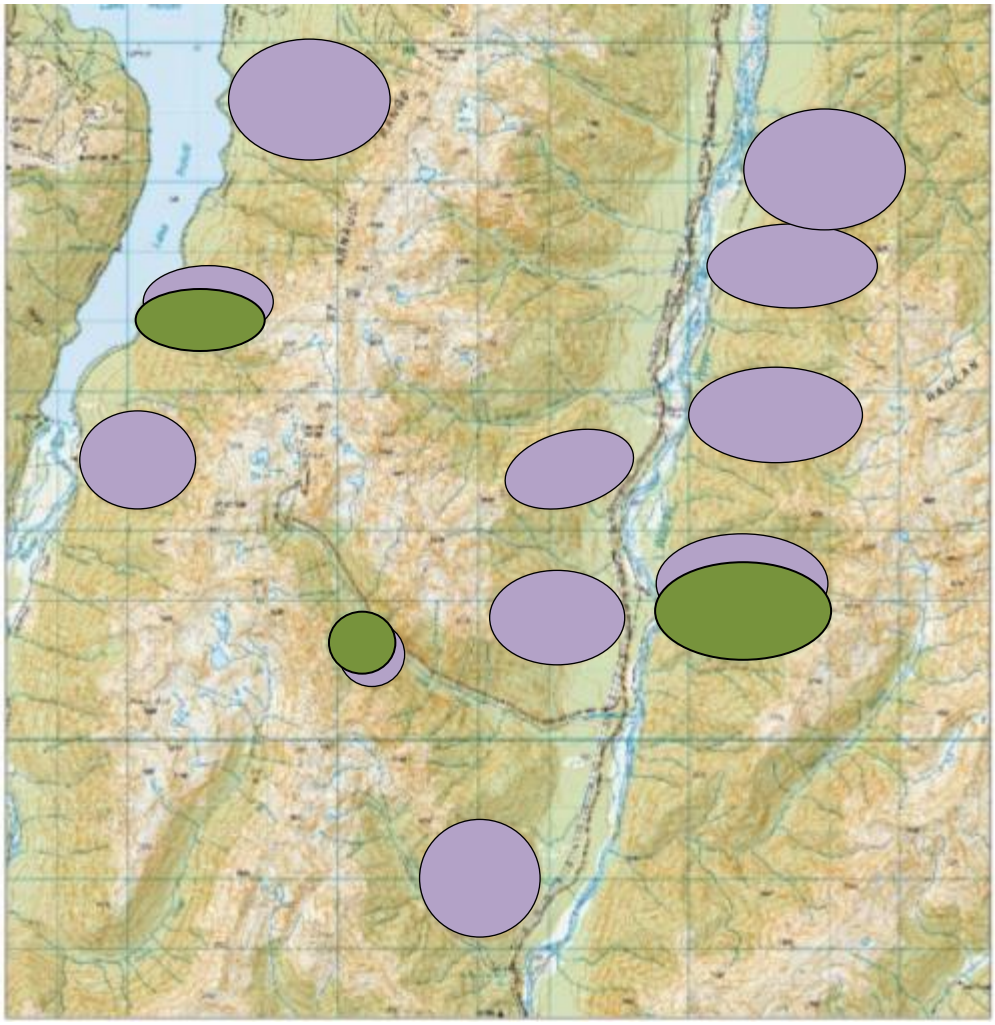
Elliott 2010 & 2013, DOC unpublished data


© James Reardon

Kea disappearances, St Arnaud Range

Repeated census (1988, 2011)



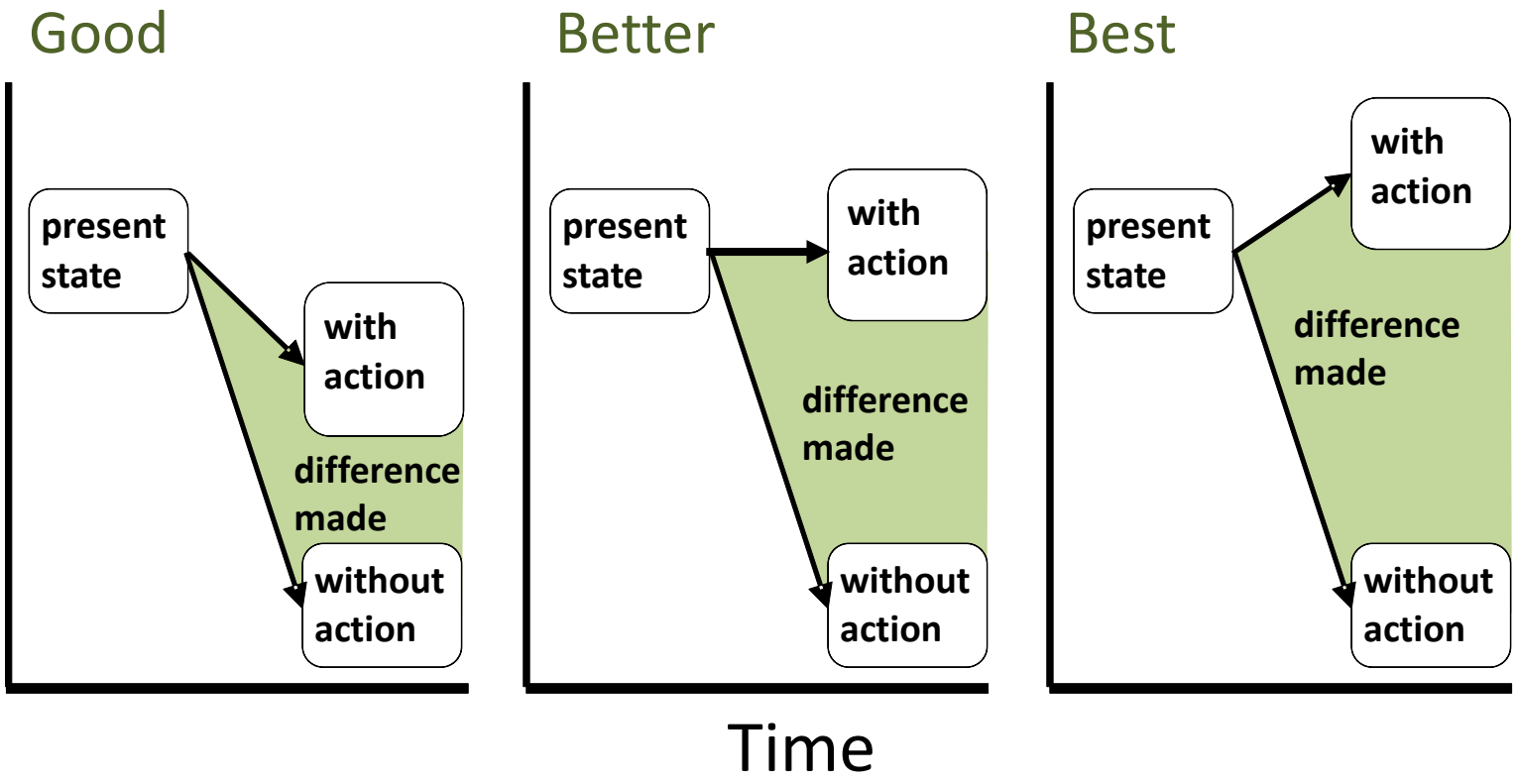


Kemp, 2013. An update on the kea population at Nelson Lakes National Park. DOC unpublished data

Areas of progress

2. Advances in mammalian predator management

Halting or reversing mainland forest species declines is (largely) a matter of scaling up



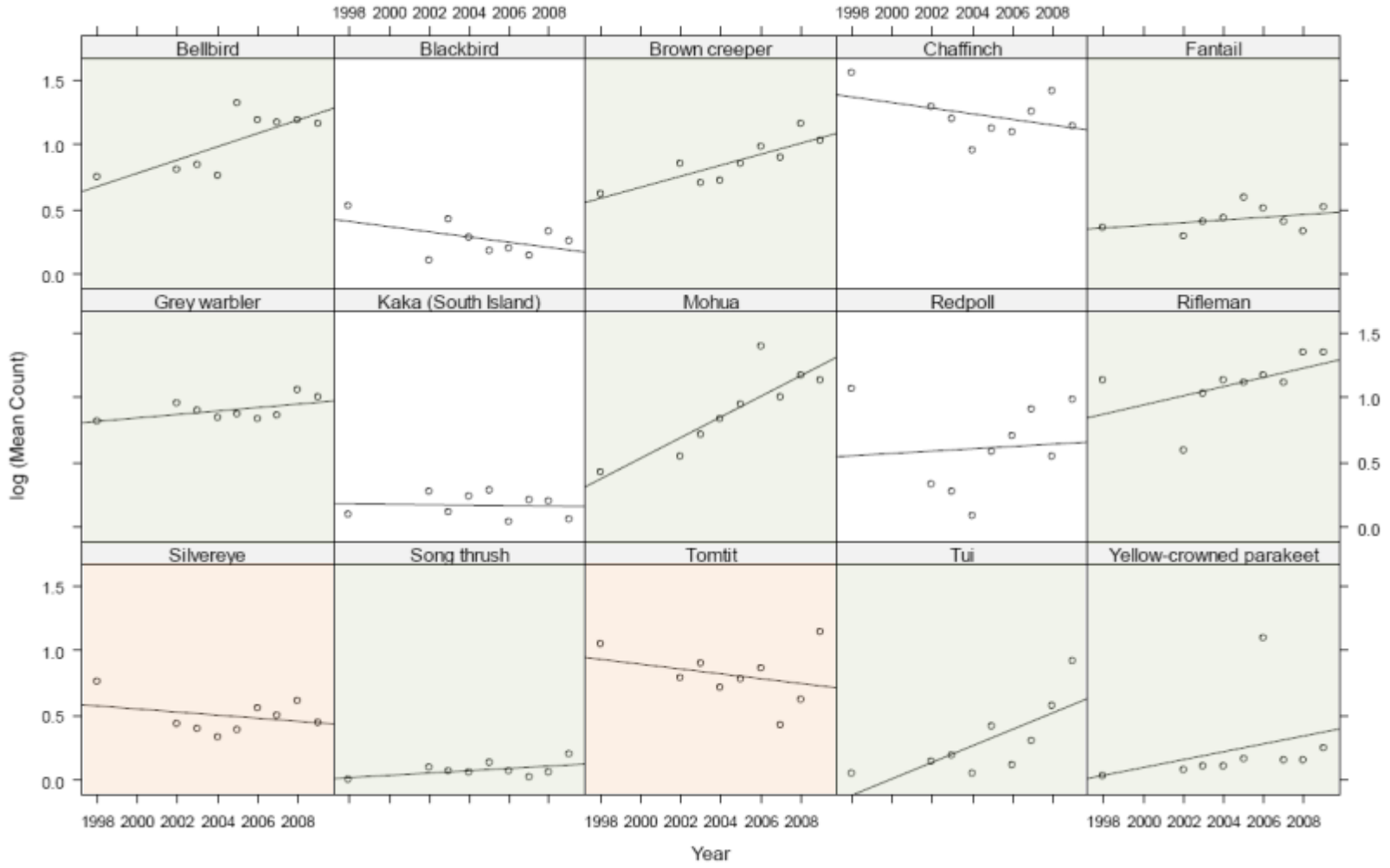
Forest bird numbers

O'Donnell & Hoare 2012. Bird recovery after pest control. New Zealand Journal of Ecology 36: 131–140

under sustained pest control, mid-Landsborough, South Westland

Significant increase

Significant decrease

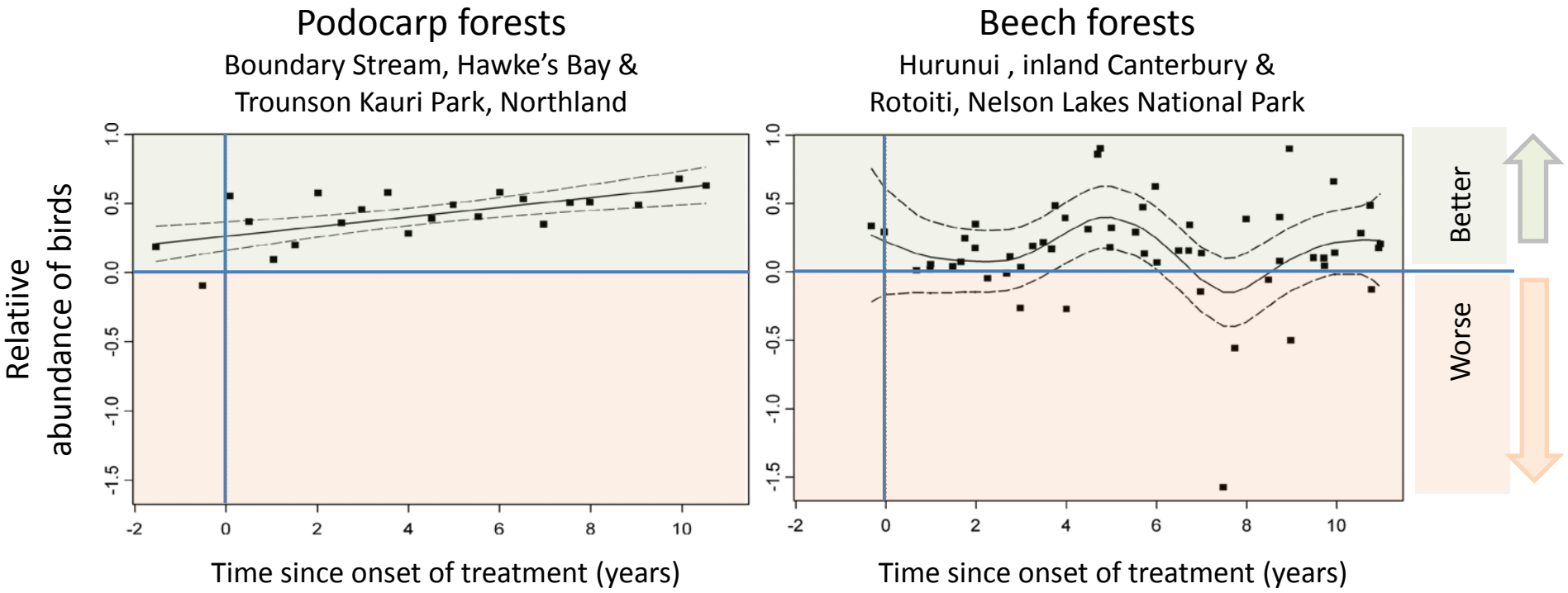


1080 drops 1998, 2000, 2004, 2009, fenn trapping for stoats from 2000

Forest bird relative abundance

in four mainland islands under sustained pest control

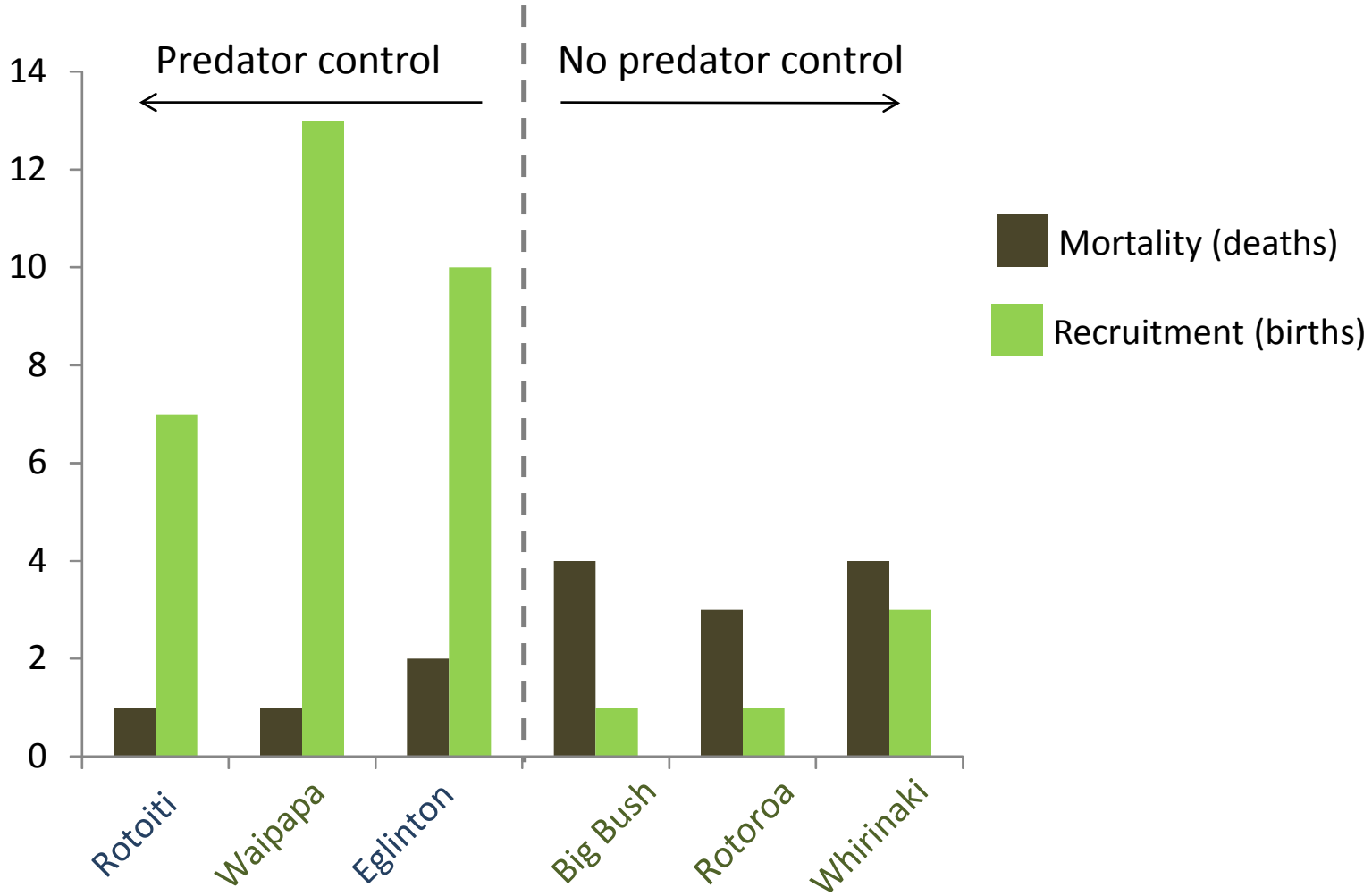
Difference between mainland island and nearby non-treatment area over time



Innes et al. 2010. What limits forest birds? New Zealand Journal of Ecology 34: 86–114

Kaka mortality and recruitment

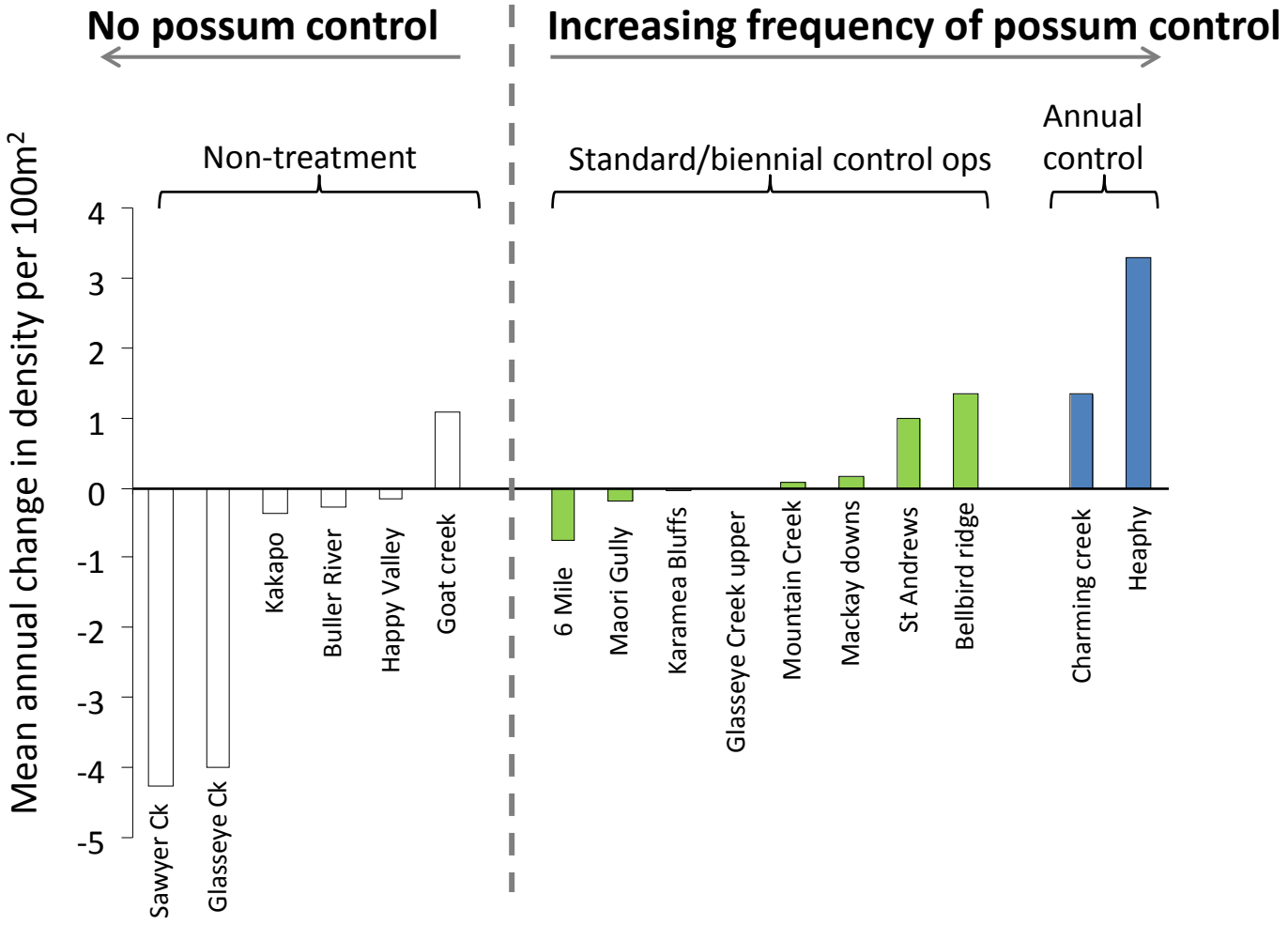
with and without predator control 1996–2000



after Moorhouse et al. 2003. Control of introduced mammalian predators improves kaka Nestor meridionalis *breeding success…Biological Conservation 1190: 33–44.*

Powelliphanta snail populations

(change in number per 100m^2 per year)



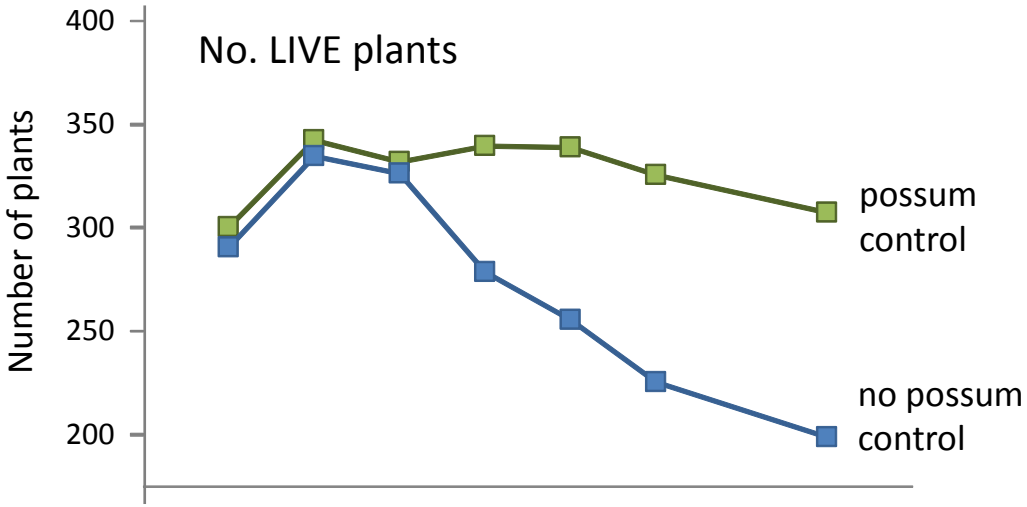
North Westland,
14 species,
16 sites,
monitored
between
1994 & 2003

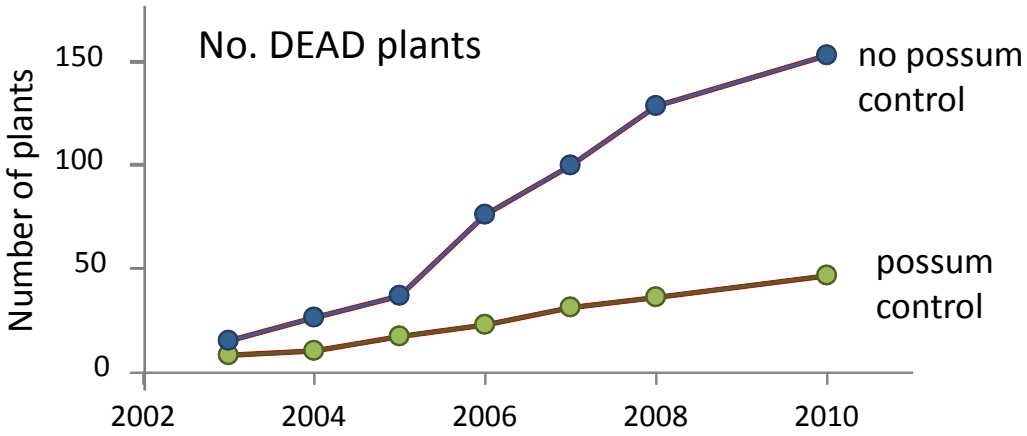
Bockett et al. 2004. Is possum control protecting Powelliphanta snails on the West Coast? DOC, unpublished data

Pittosporum patulum

with and without possum control

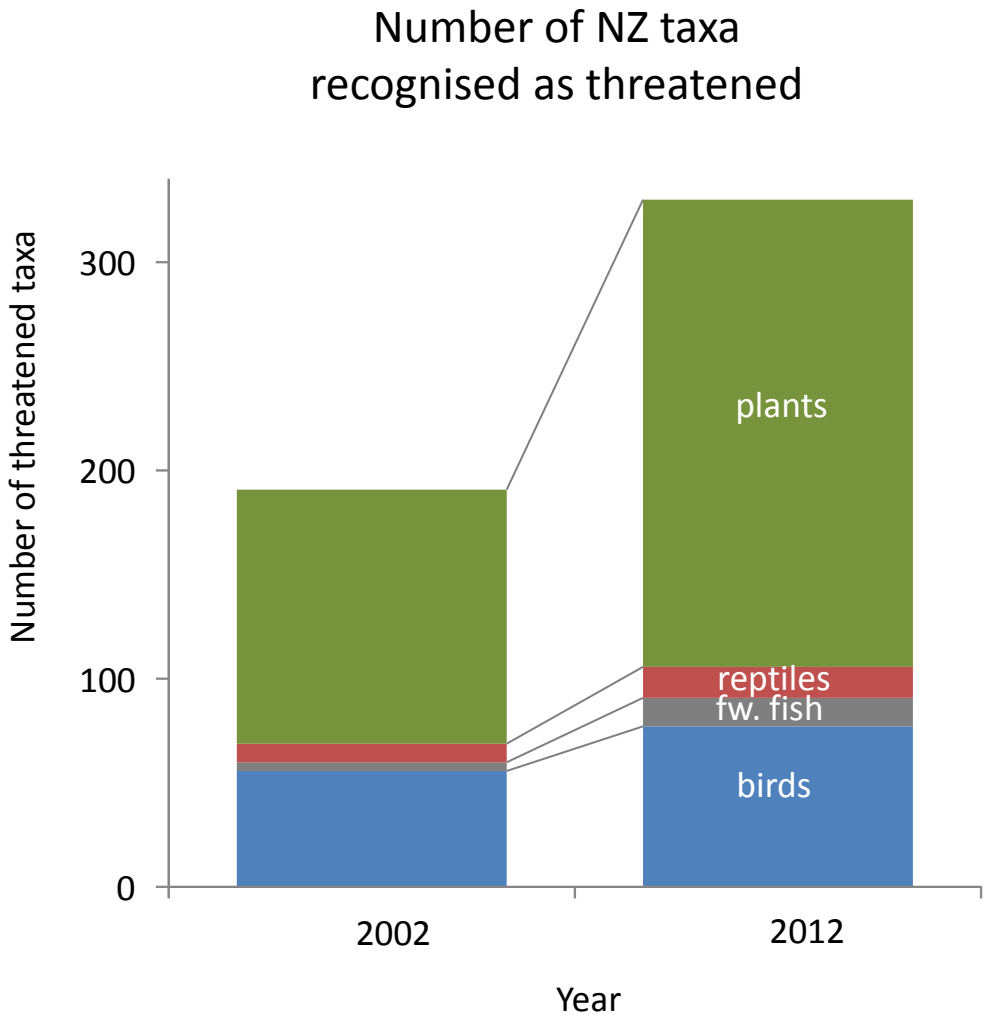
Populations in Dobson, Huxley & Temple valleys
Upper Waitaki, 2003 – 2010





Comrie, Head. DOC unpublished data

Three credible reasons
for growing numbers of species in decline

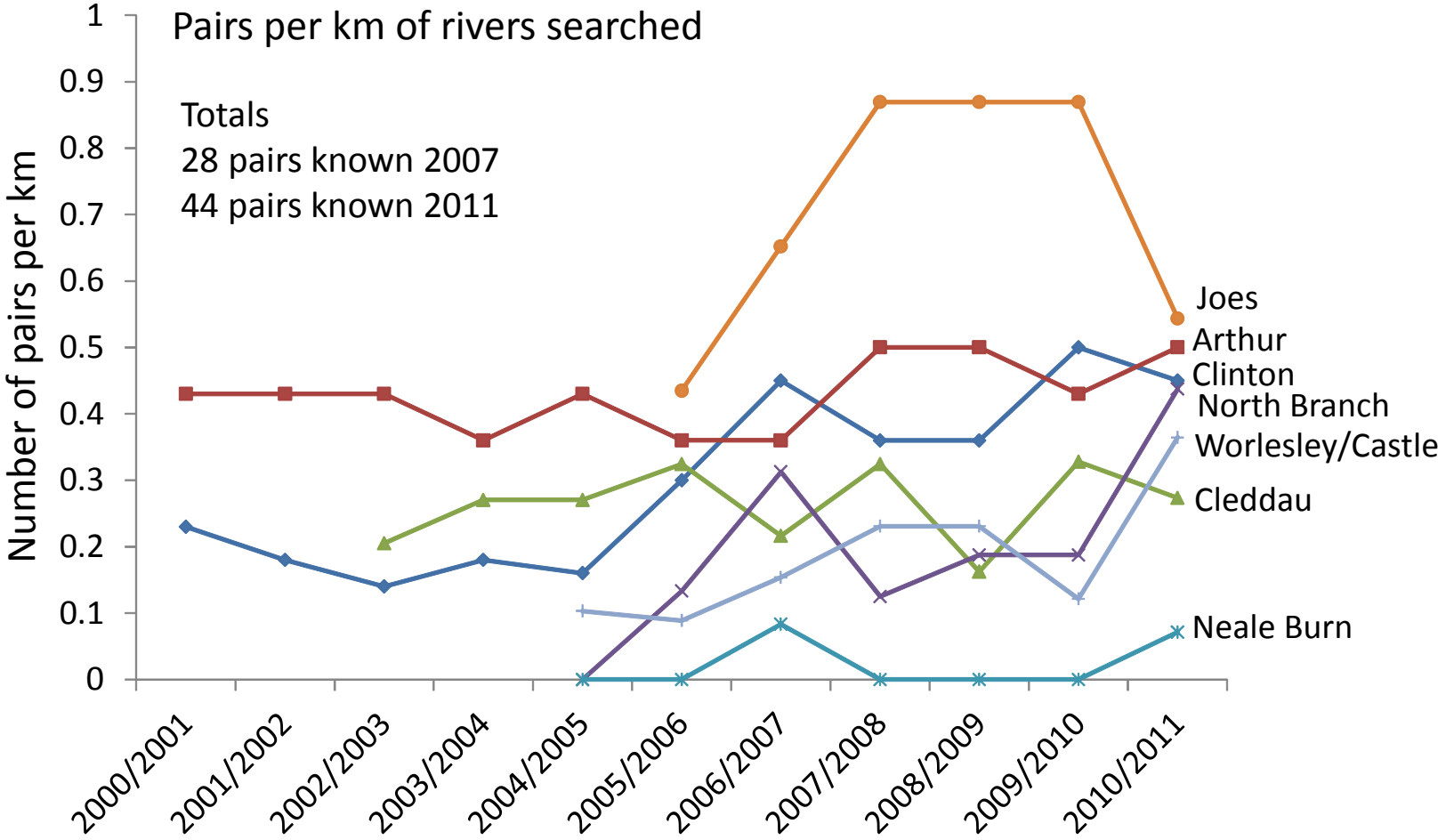


Reason No 1.

Landscape-scale predator management evades us

Numbers of Fiordland whio

in managed populations (stoat trapping, translocations)



Andrew Smart, DOC, unpublished data

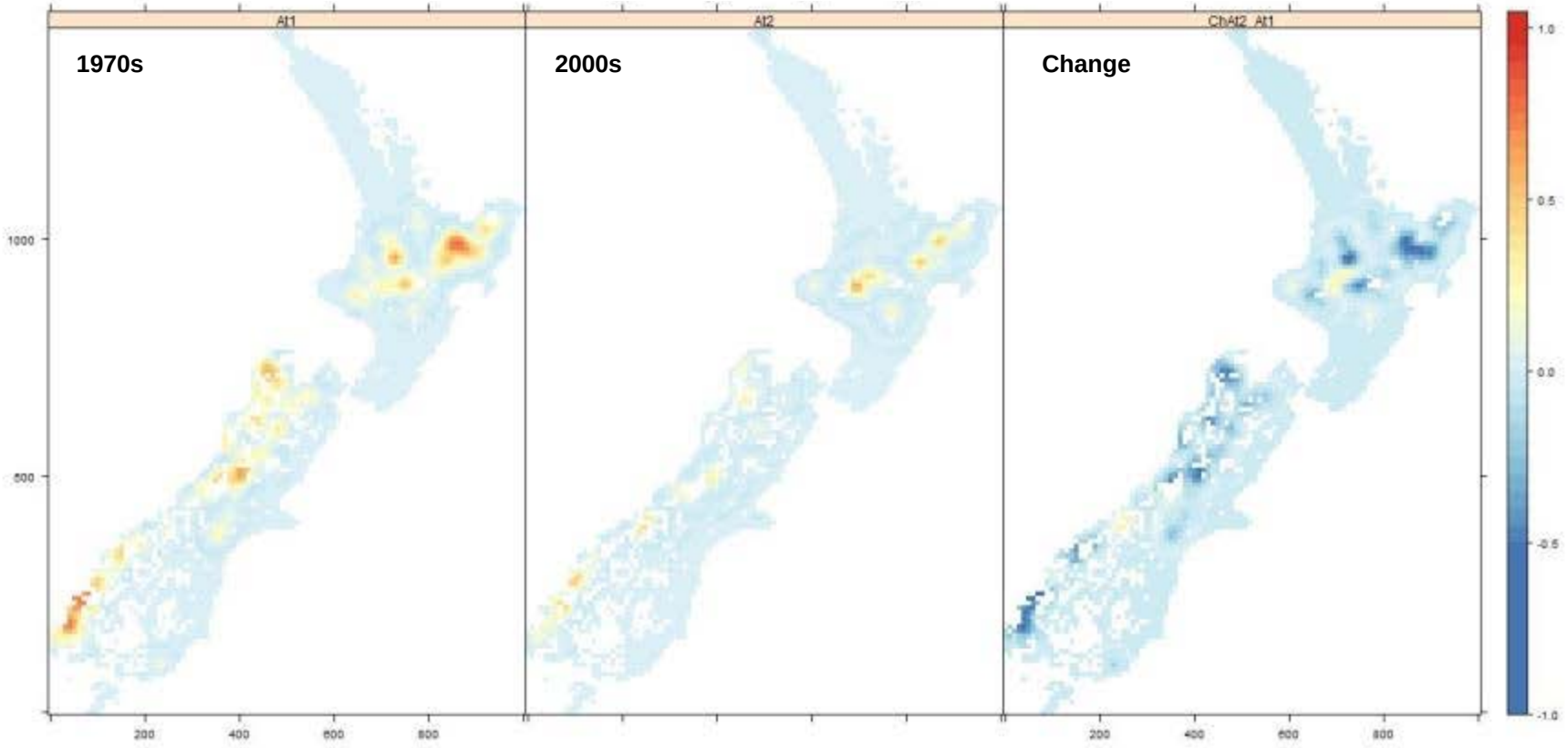
FOR ESTIMATED DECLINES IN THE ABSENCE OF MANAGEMENT SEE

Whitehead 2010. Large-scale predator control increases population viability of a rare New Zealand riverine duck. Austral Ecology 35: 722–730

Whio

Occupancy

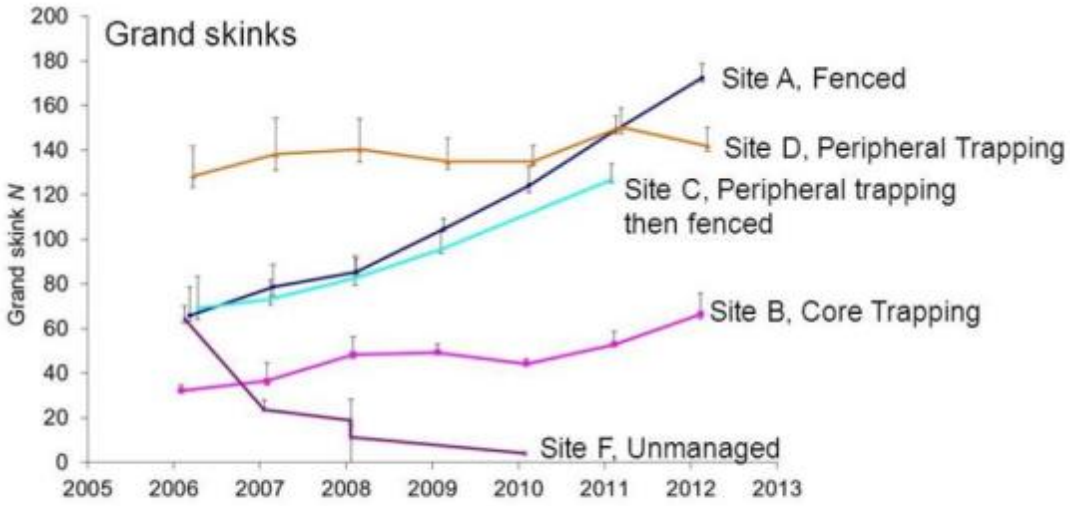
Blue duck (Nationally Vulnerable)



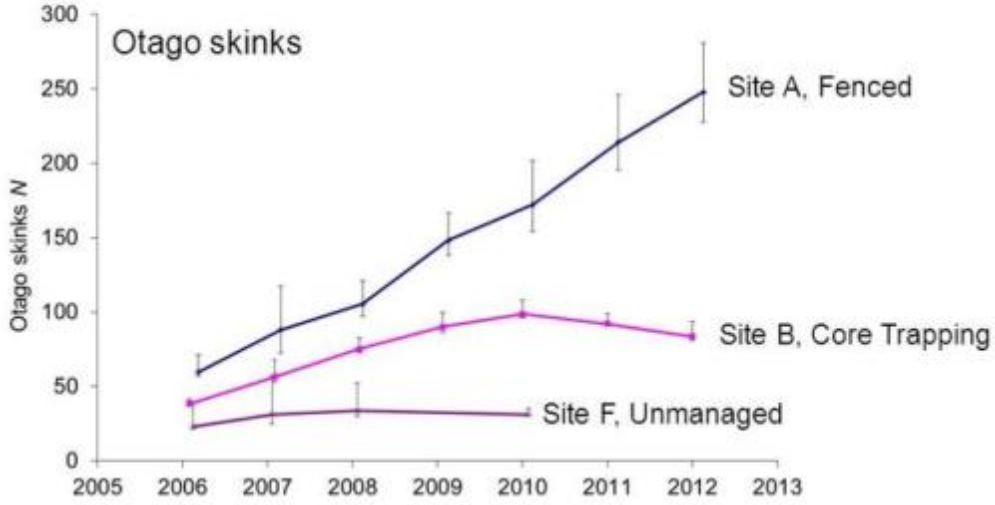
Walker and Monks in prep.
based on Ornithological Society of New Zealand data
in Bull et al. 1985 and Robertson et al. 2007

Grand and Otago skinks

in an experimental management trial, Macraes Flat, Otago



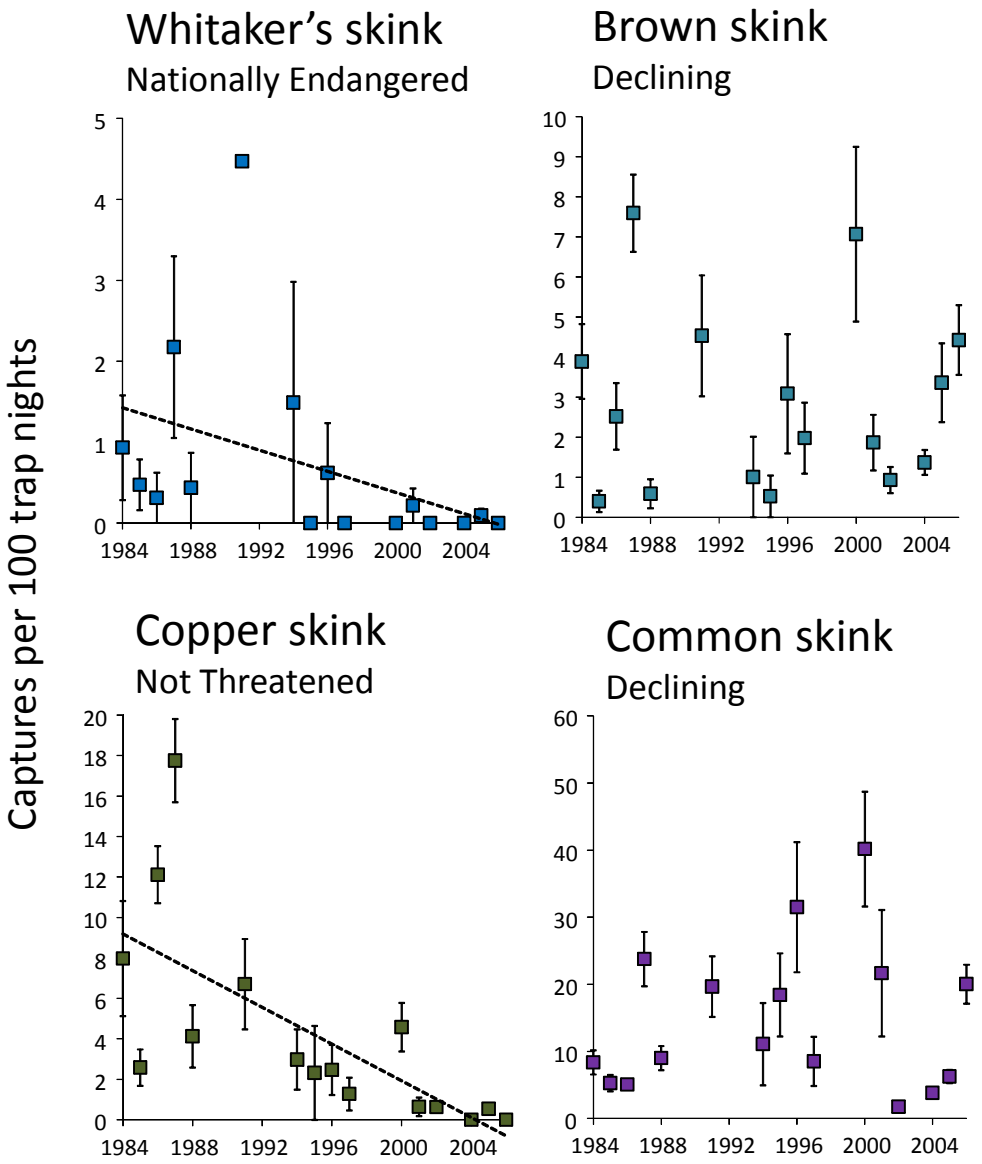
Grand and Otago Skink Recovery Group, DOC unpublished data



Four species of lizard

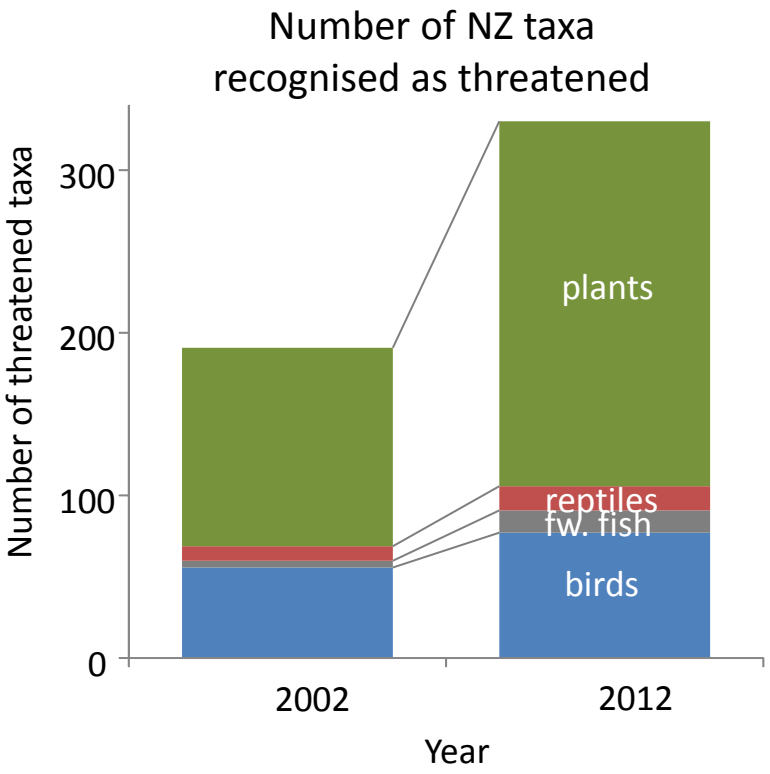
Pukerua Bay, near Wellington, 1984–2006

Records the disappearance of the last mainland population of Whitaker's skink



Hoare et al. 2007. Attempting to manage complex predator-prey interactions. Journal of Wildlife Management 71: 1576–1584

Reason No 2. Habitat conversion and species overexploitation continues



High country tussock and freshwater habitat conversion

Fyke net of longfin eels

Longfin eel (Declining)

Common skink, Rangitata riverbed

Oligosoma aff. *polychroma* Clade 5 (Declining)

20 ha of remaining lizard habitat on the Canterbury Plains, cleared Autumn 2014

Pillow pimelea in the Upper Clutha

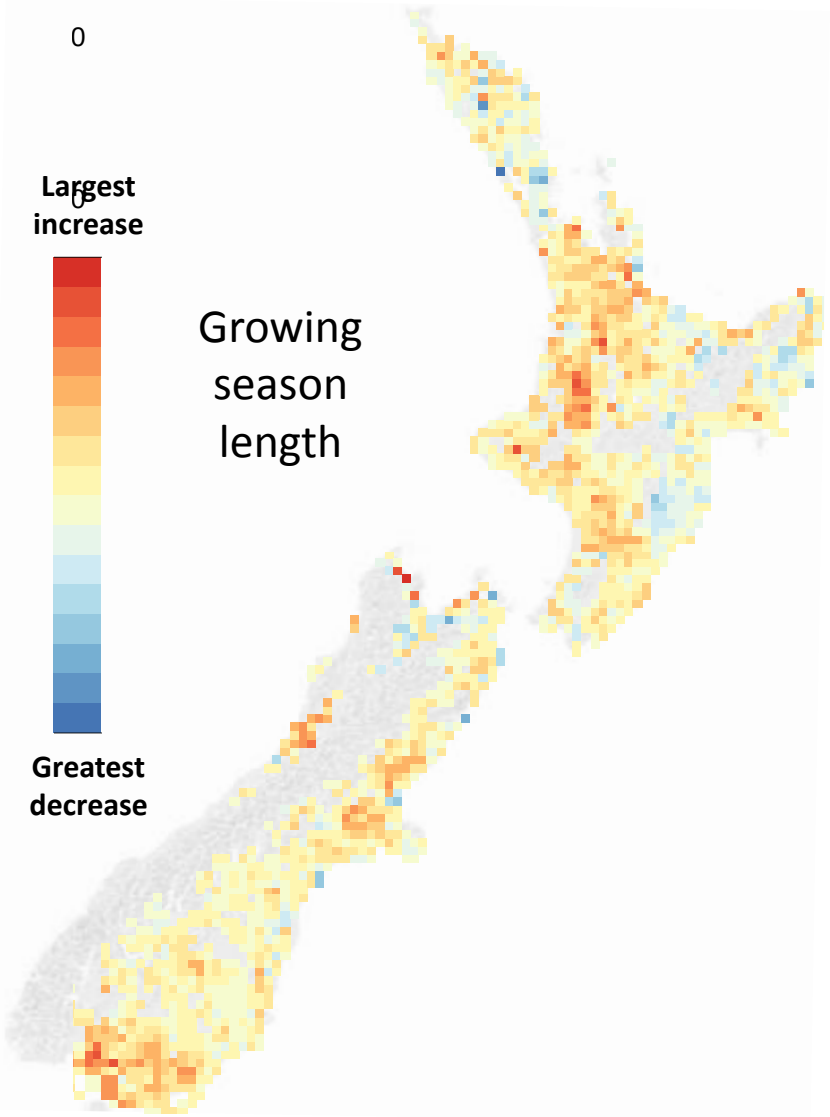
Pimelea sericeovillosa subsp. *pulvinaris* (Declining)

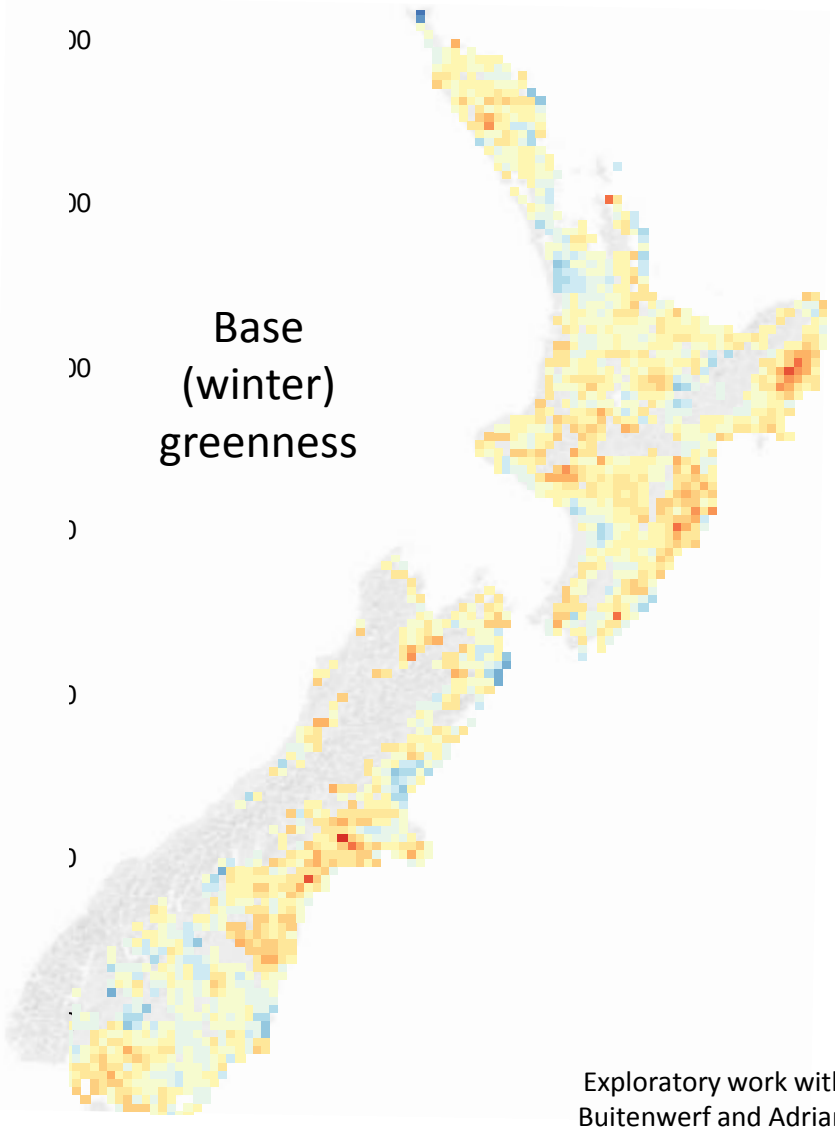
Largest remaining population (10,000+ plants, Upper Clutha) disked in autumn 2014

Land use intensification

also entails habitat conversion

'Greenness' changes in production landscapes,1970s to mid-2000s





Exploratory work with Robert Buitenwerf and Adrian Monks

Canterbury plains ‘dryland’ kanuka remnants

Watering the Eyrewell Scientific Reserve

Culverden Scientific Reserve's exotic grass sward

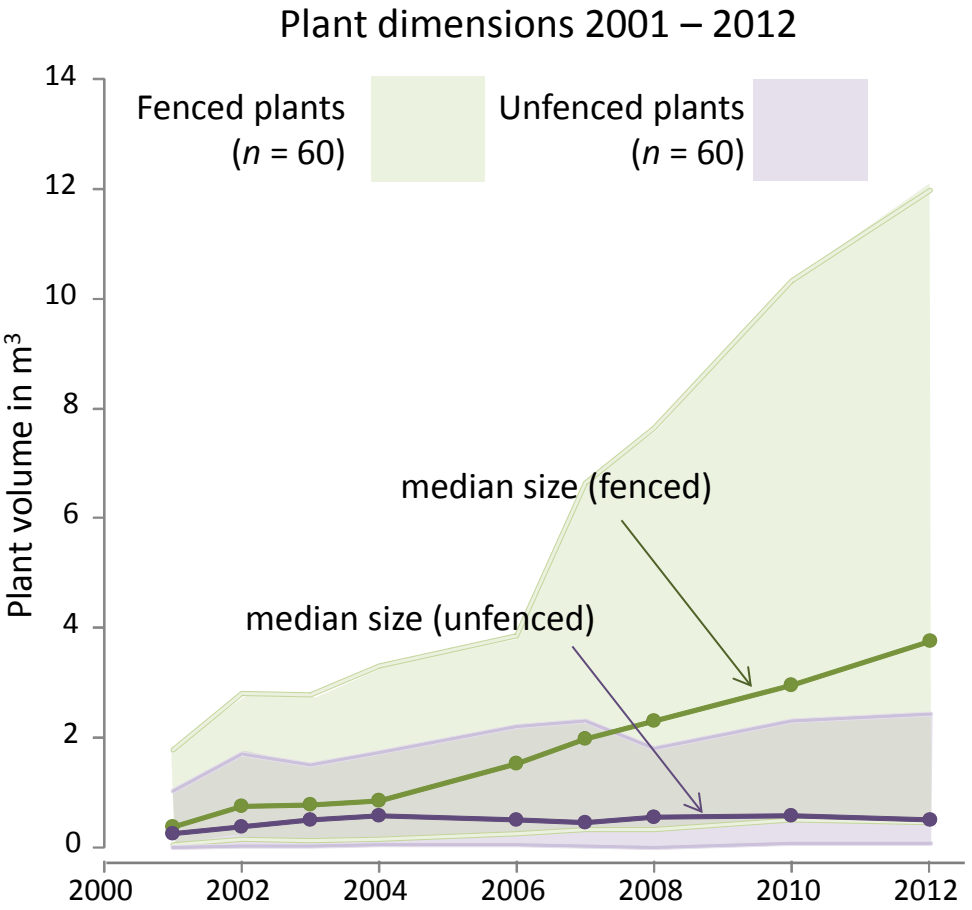





Shrubby tororaro, Kaitorete Spit

(*Muehlenbeckia astonii,* Nationally Endangered)

Recovery of plants from browse, but no recruitment…



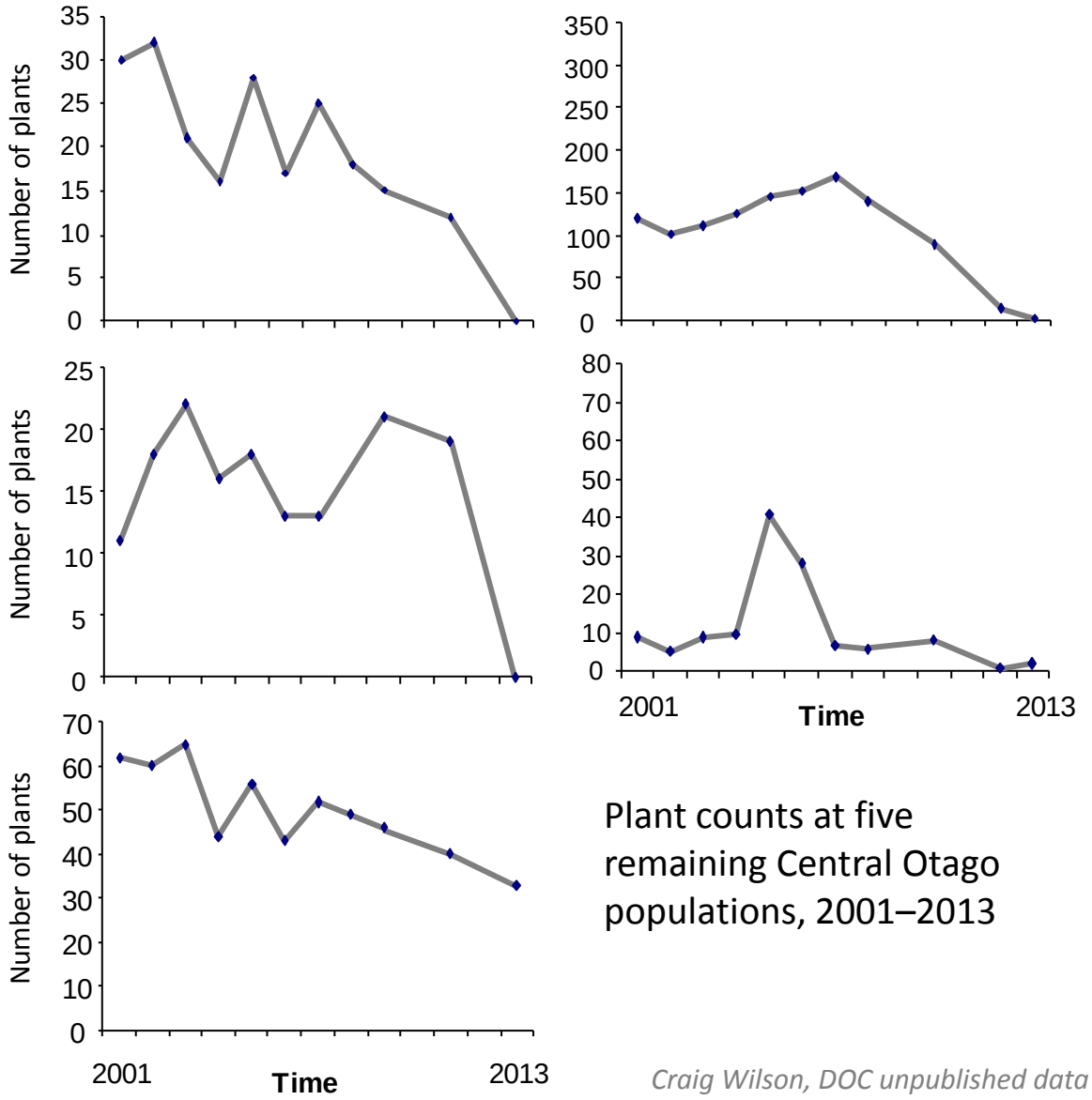
Spenser, Head. DOC unpublished data

Lepidium solandri , Nationally Endangered
(photo: John Barkla)

Dryland cress in Central Otago

(*Lepidium solandri* , Nationally Endangered)

Rapid, simultaneous demise of remaining populations



Plant counts at five remaining Central Otago populations, 2001–2013

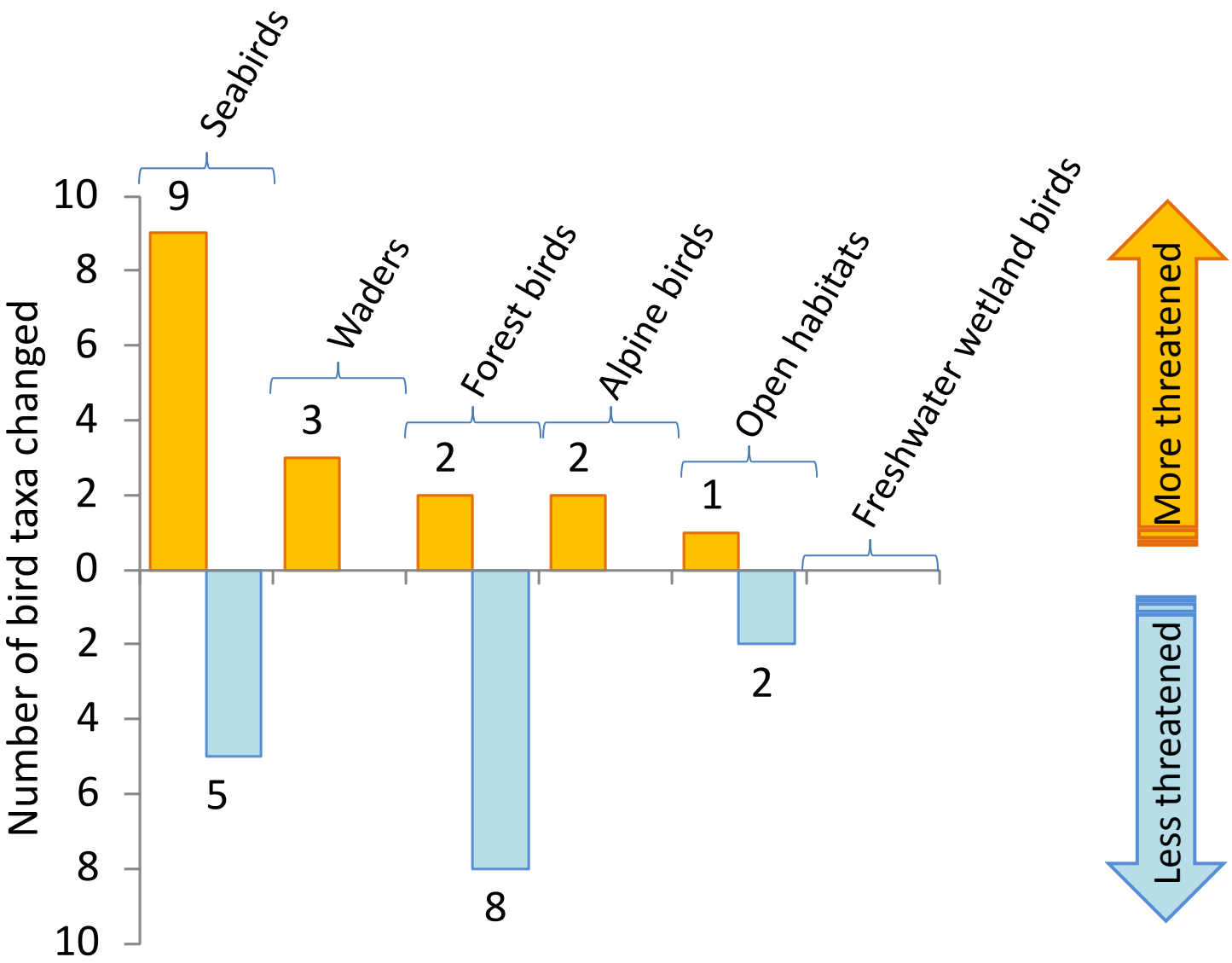
Craig Wilson, DOC unpublished data

Reason No 3.

Climate change

Bird threat status changes

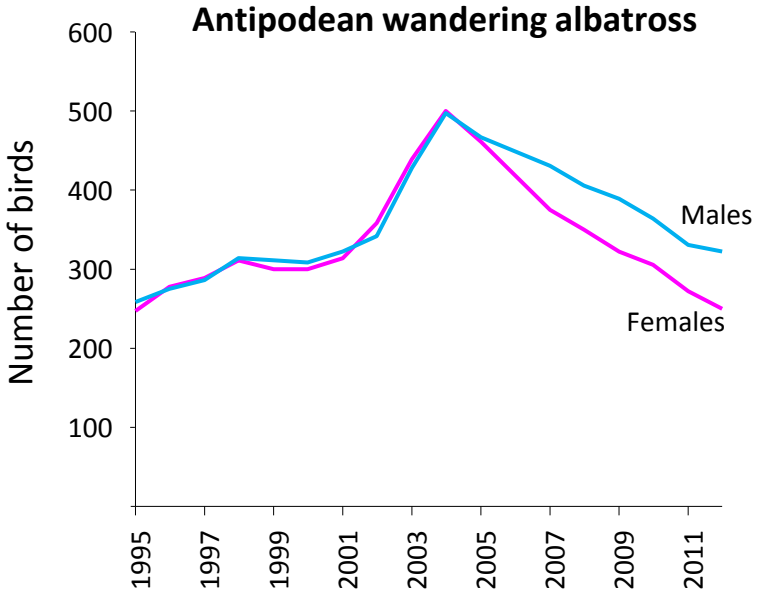
2008 to 2012, by group

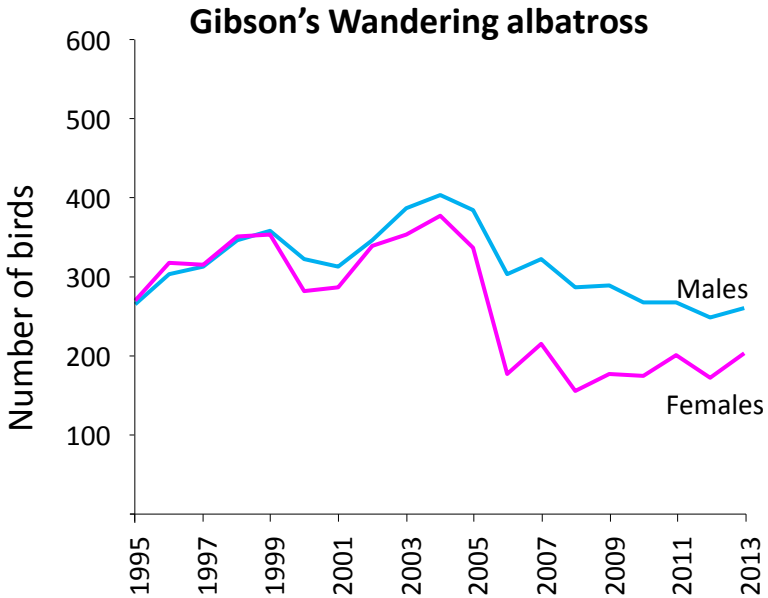


Wandering albatrosses

Declines and diminishing sex ratios

Numbers of birds estimated using mark-recapture methods, 1995 to present



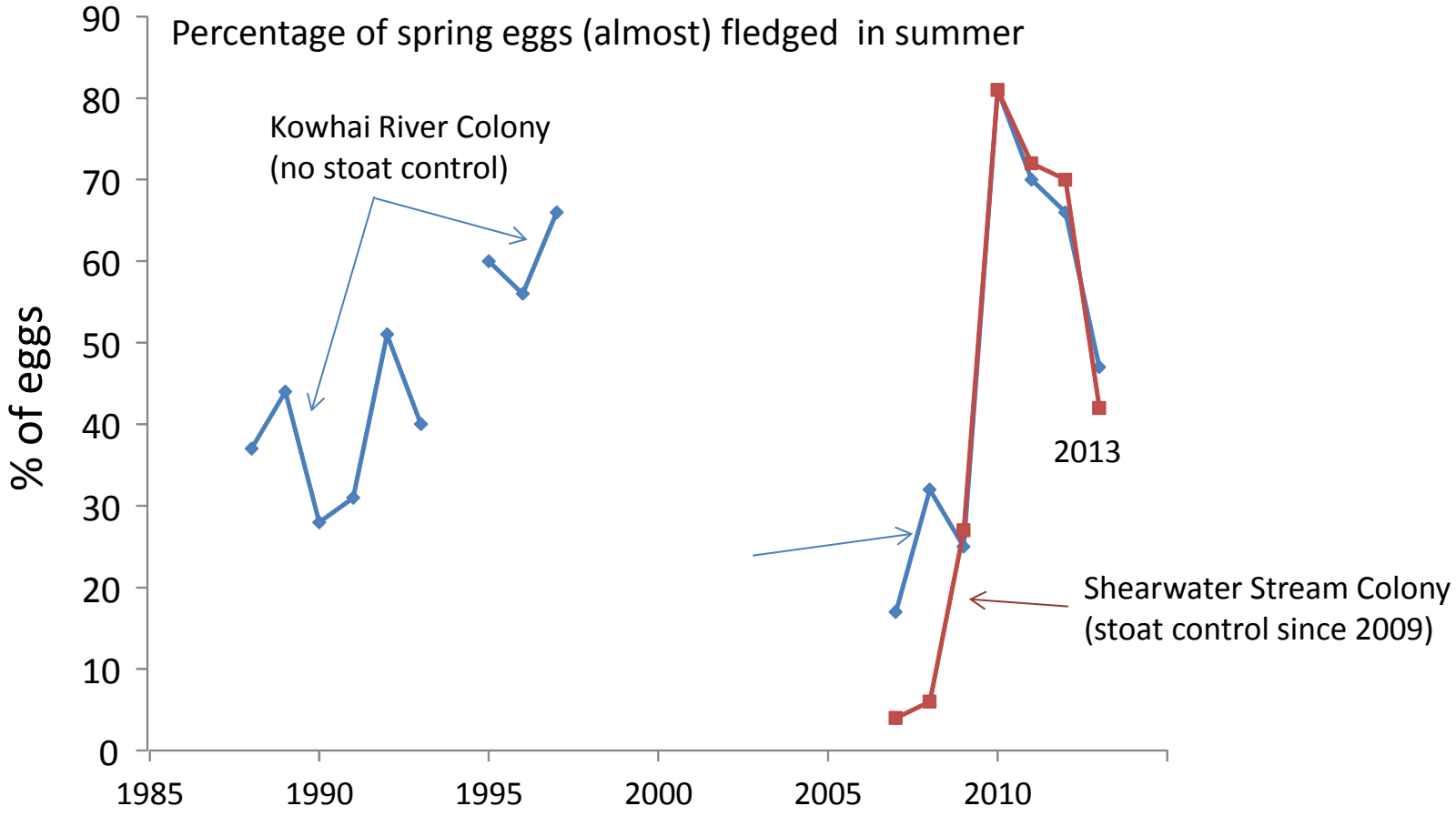


Kath Walker & Graeme Elliot, personal unpublished data

Hutton's shearwaters

in two Kaikoura colonies

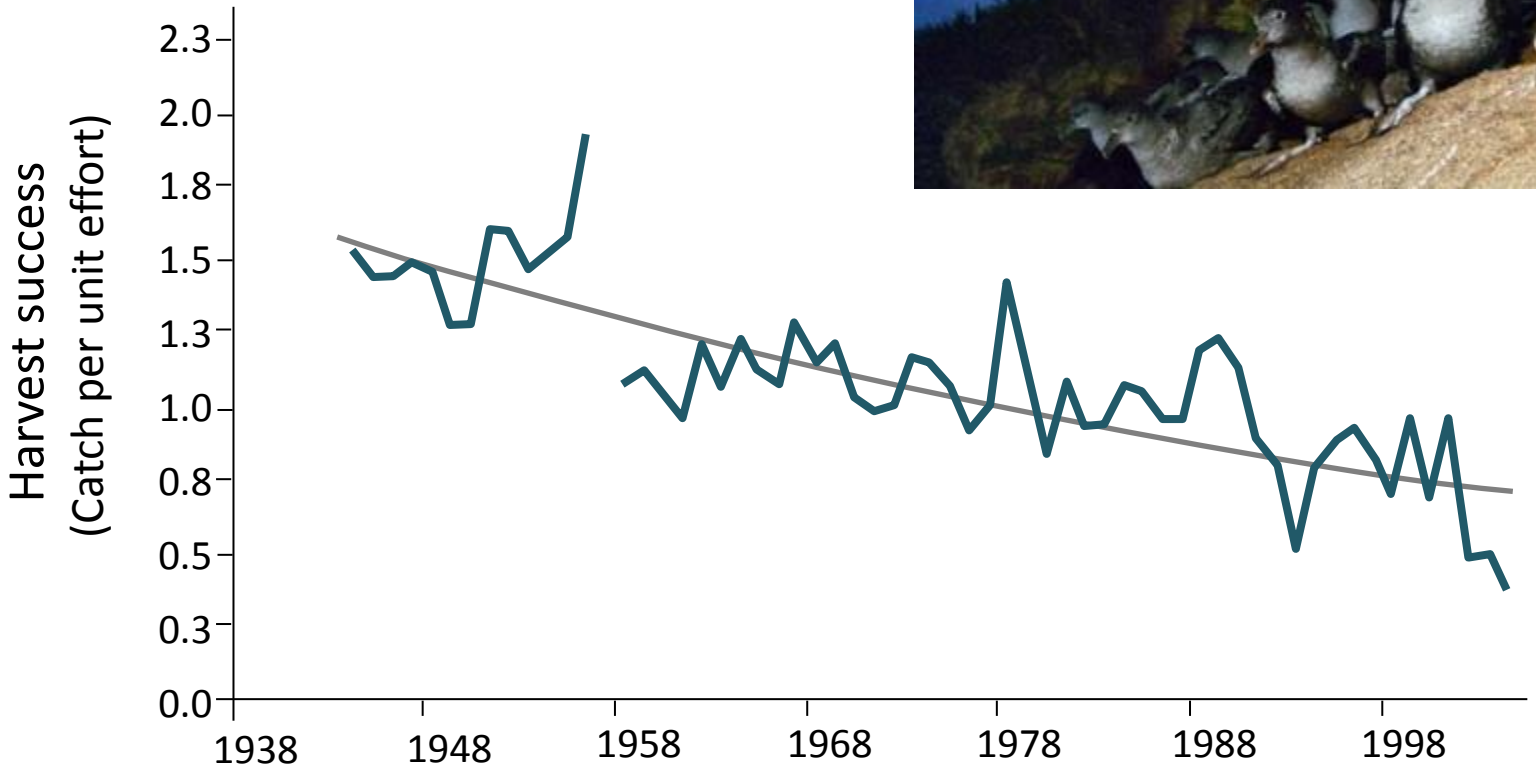
Breeding success is 'episodic'
and not explained by predation



Cuthbert & Somer, Bradfield, DOC unpublished data

Titi on Rakiura over 70 years

Harvest success from 9 ‘harvest diaries’

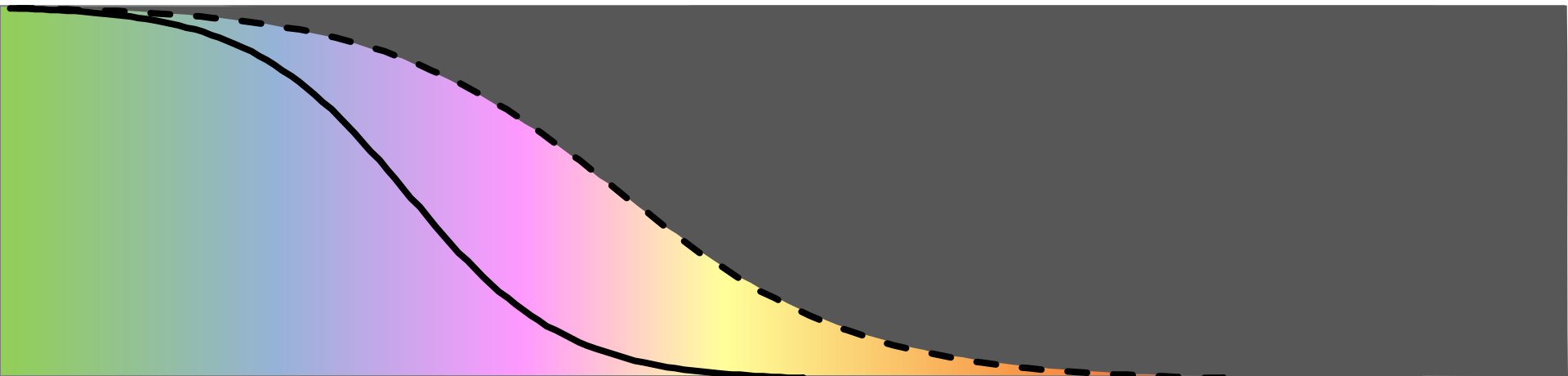


Henrik Moller et al., University of Otago, unpublished data

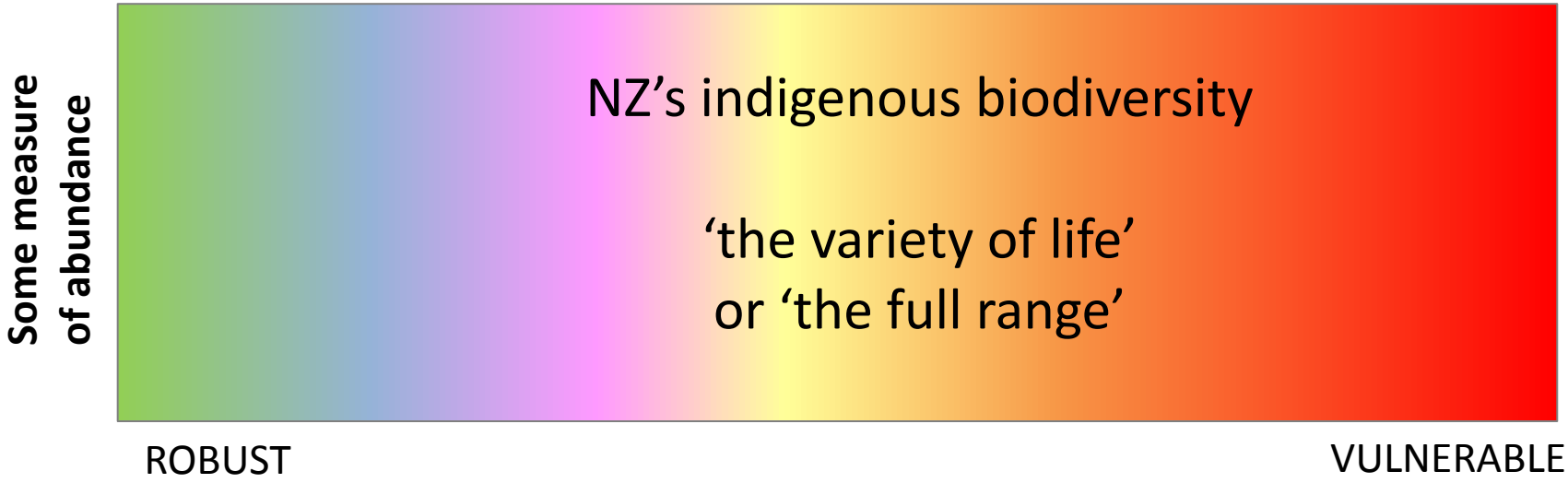
Summing up Part I

Growing numbers of species in decline

- More and more New Zealand species are known to be, or are being, reduced to low numbers
- Predators, habitat conversion and overexploitation are the major causes
- Climate change is starting to exacerbate the effects of both

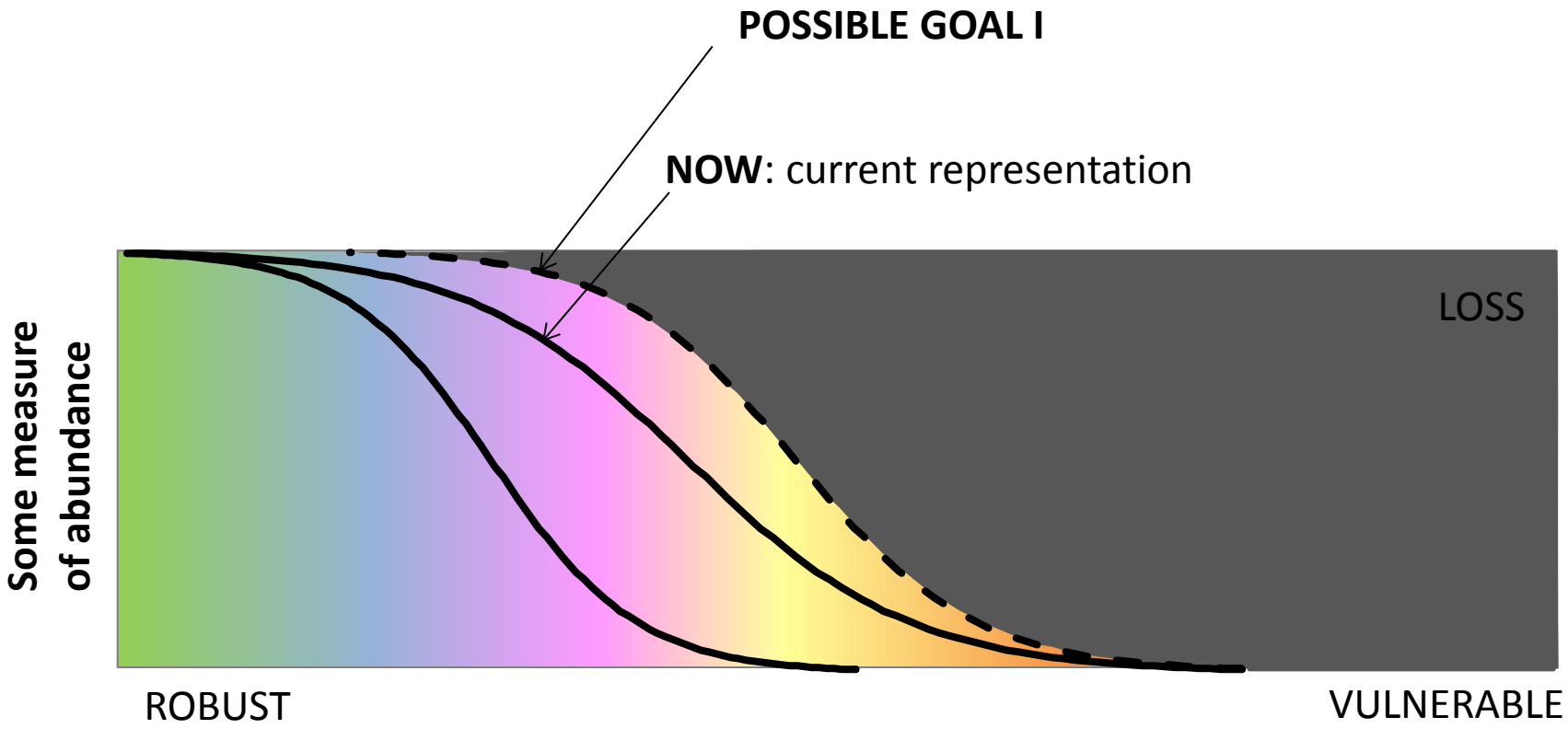


Goals


Some measure of abundance
NZ's indigenous biodiversity
'the variety of life'
or 'the full range'
ROBUST
VULNERABLE

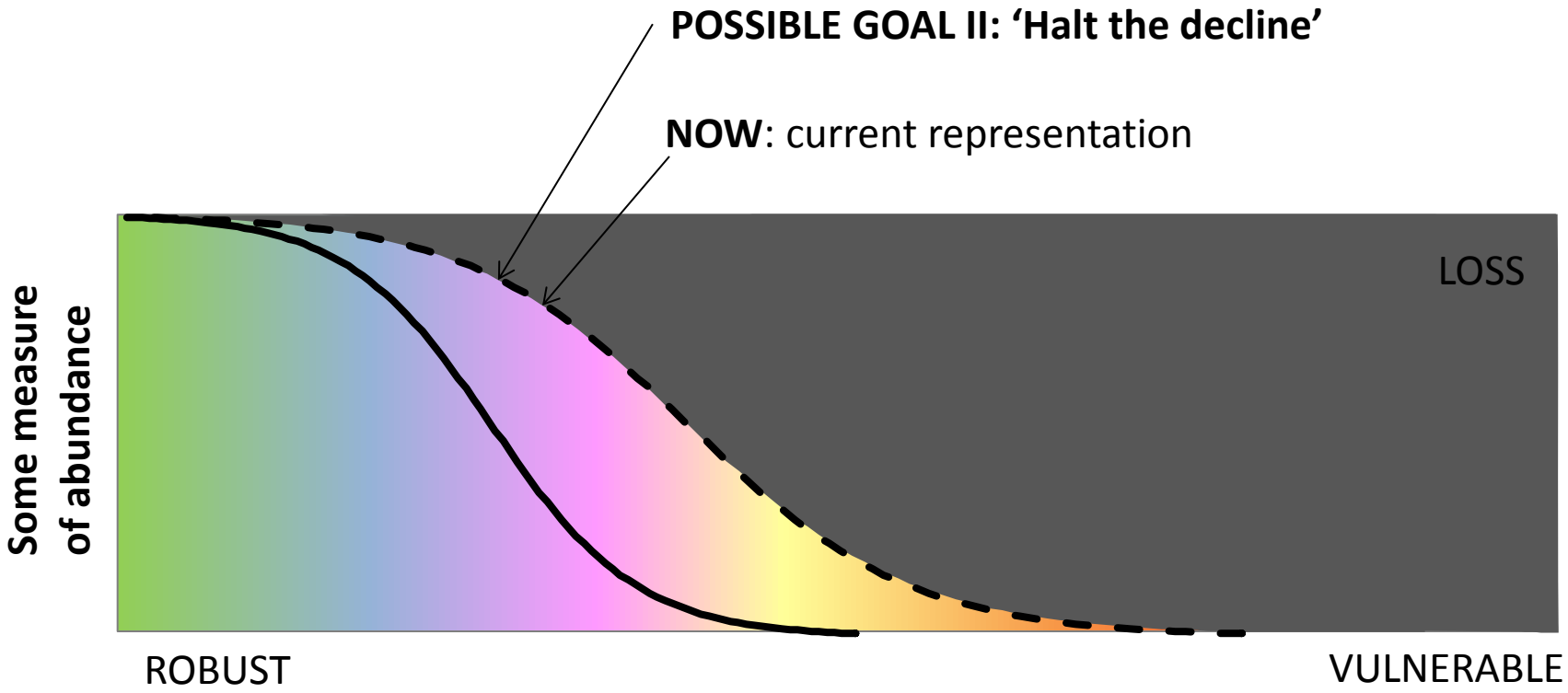
Goals

‘Reverse the decline’



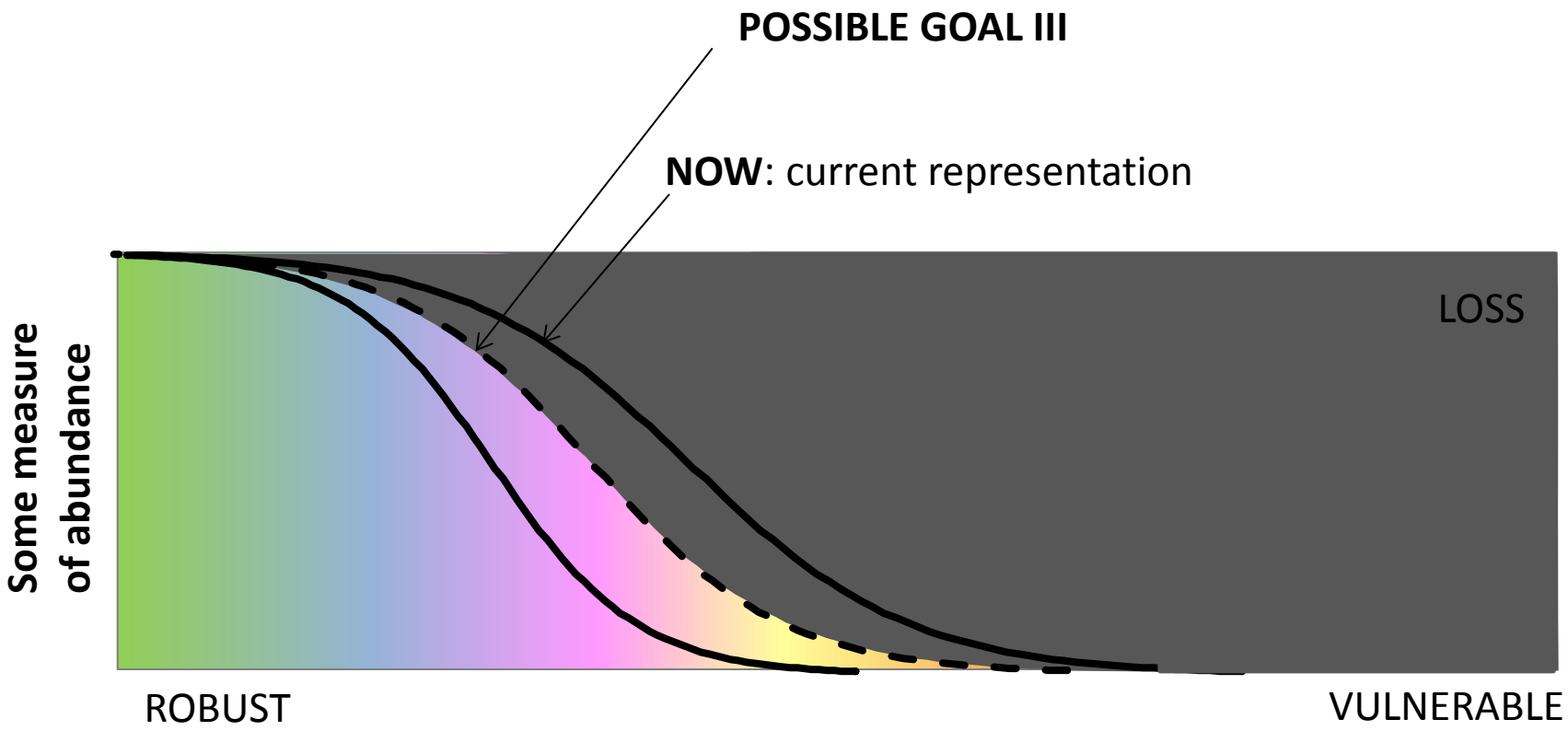
Goals

‘Halt the decline’

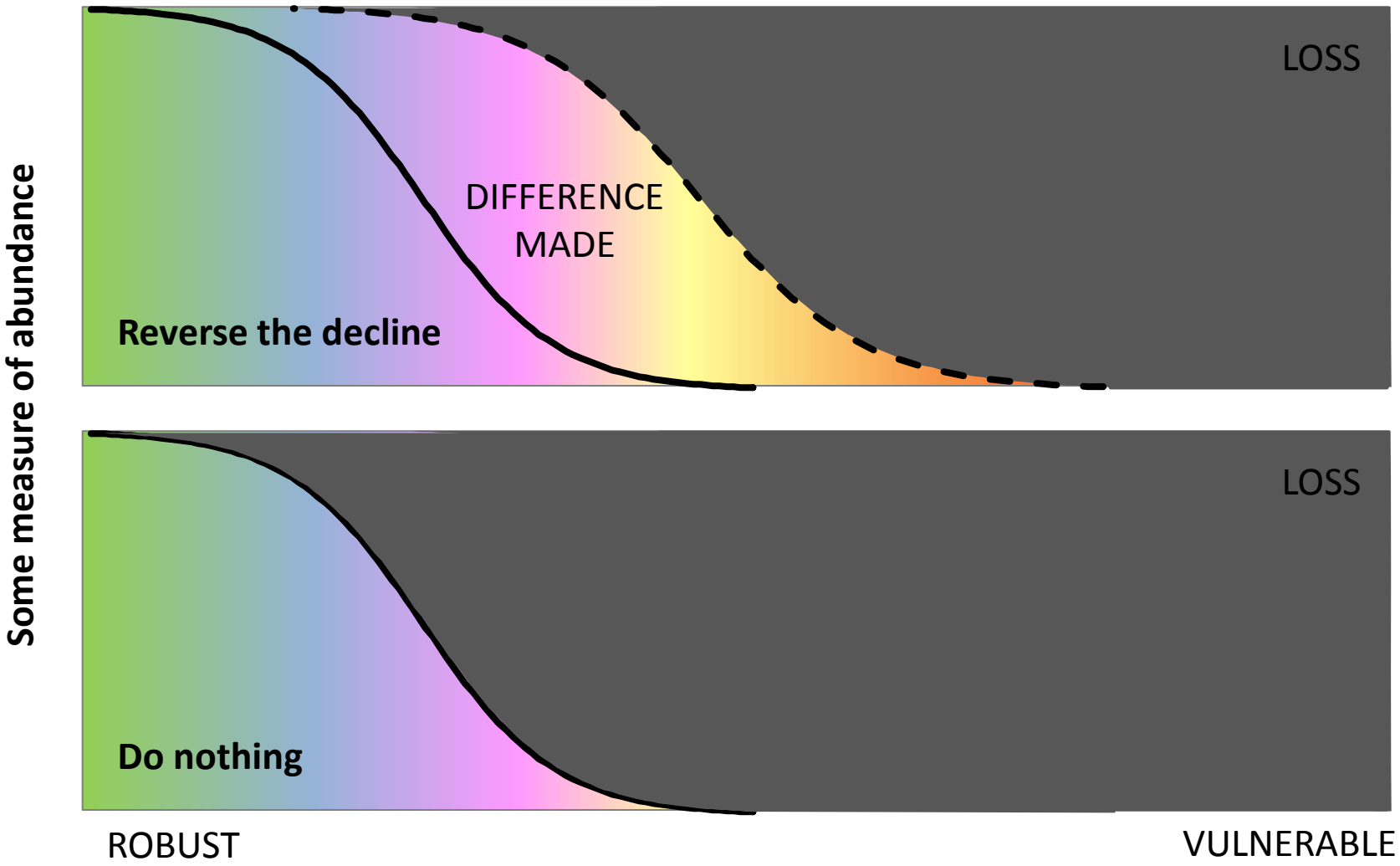


Goals

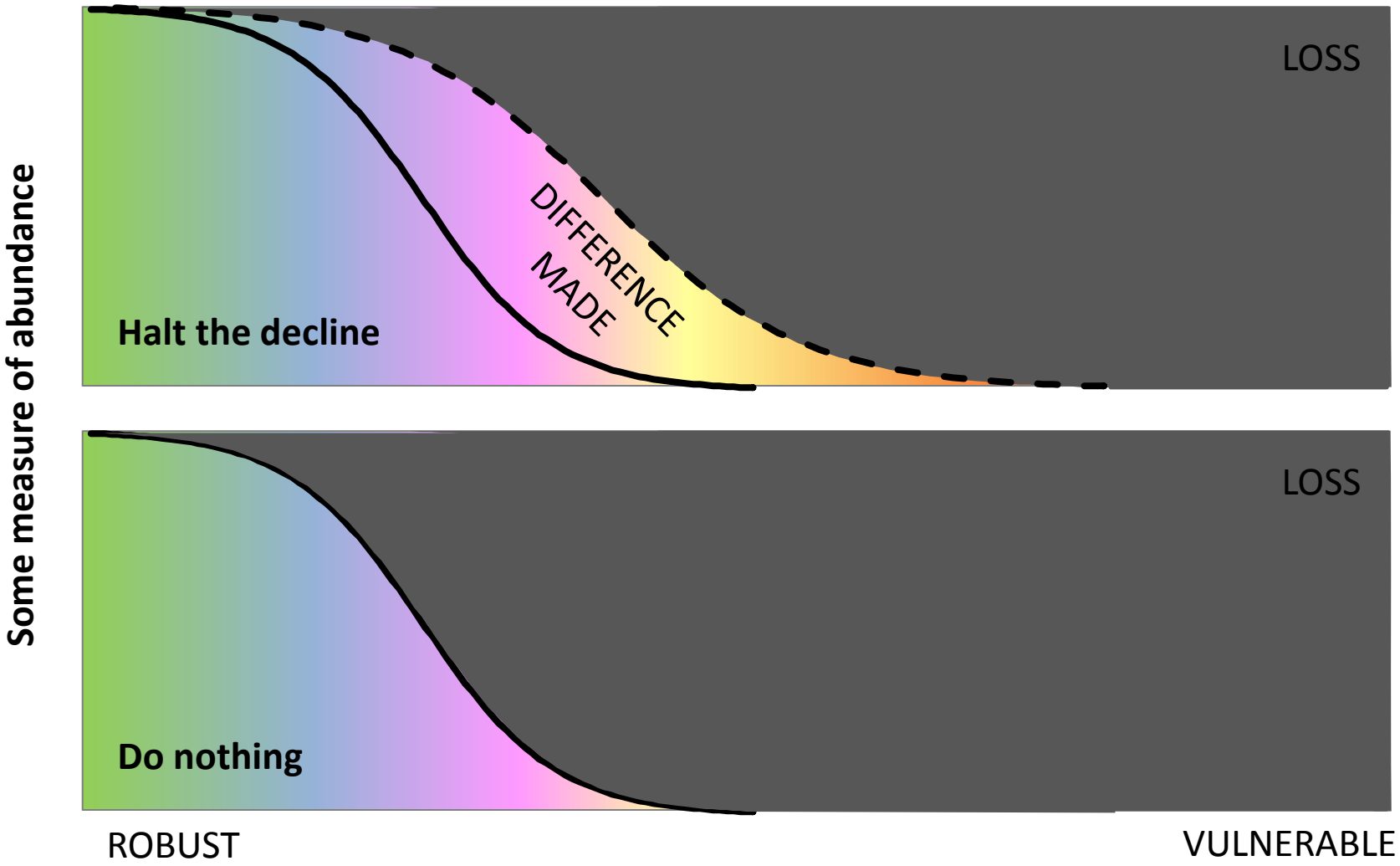
‘Slow the decline’



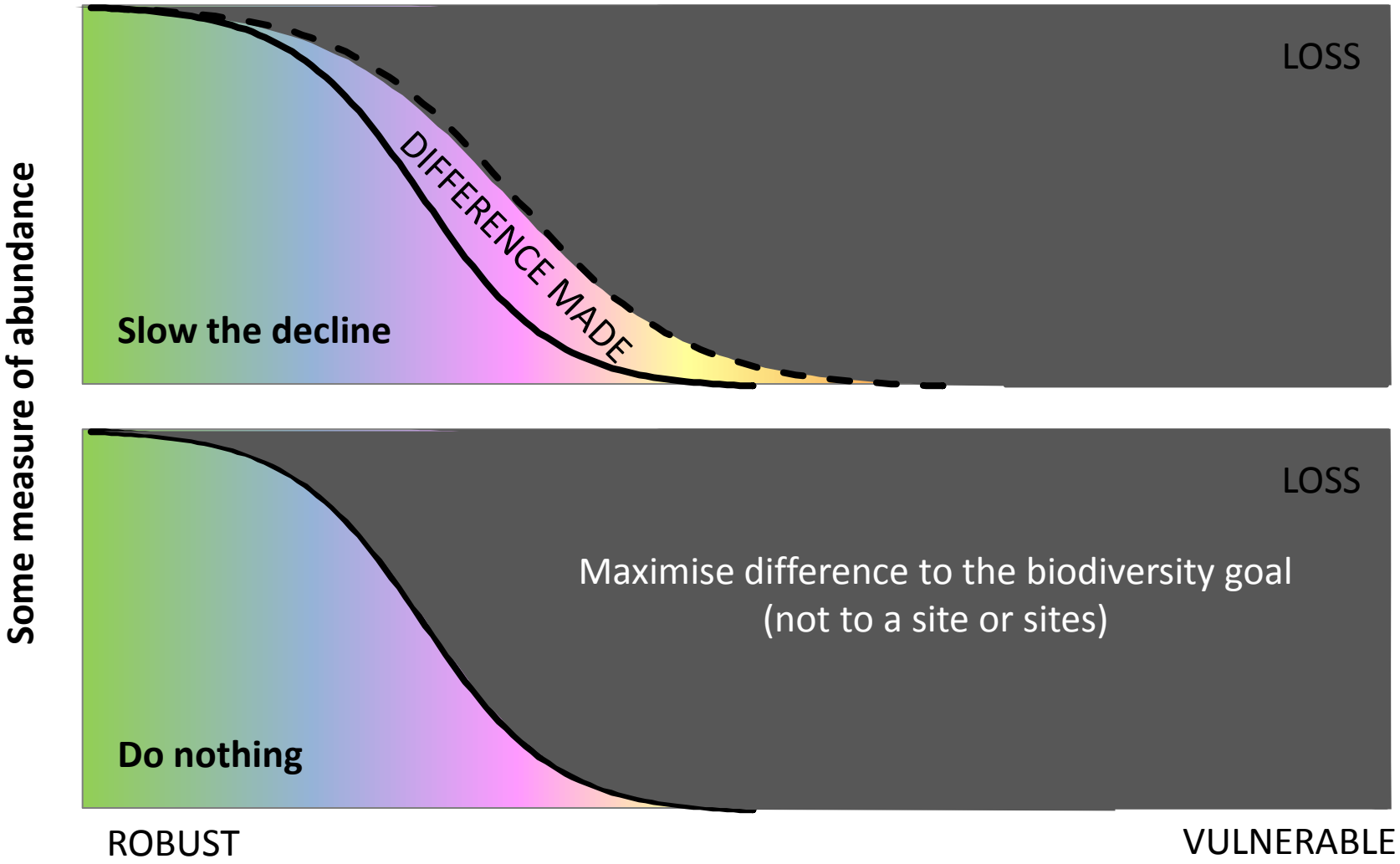
Difference is made by changing the fate of vulnerable biota



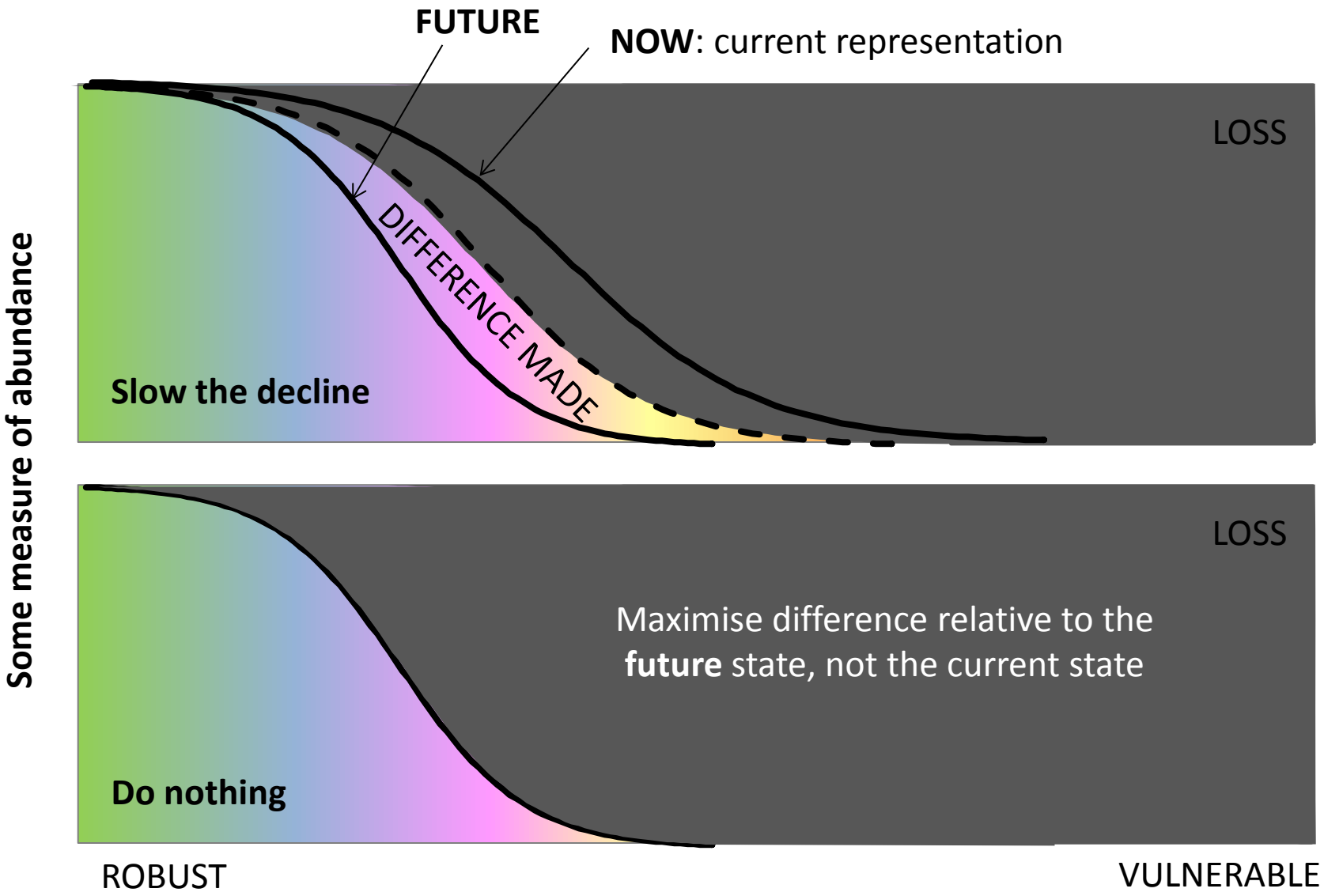
Difference is made by changing the fate of vulnerable biota



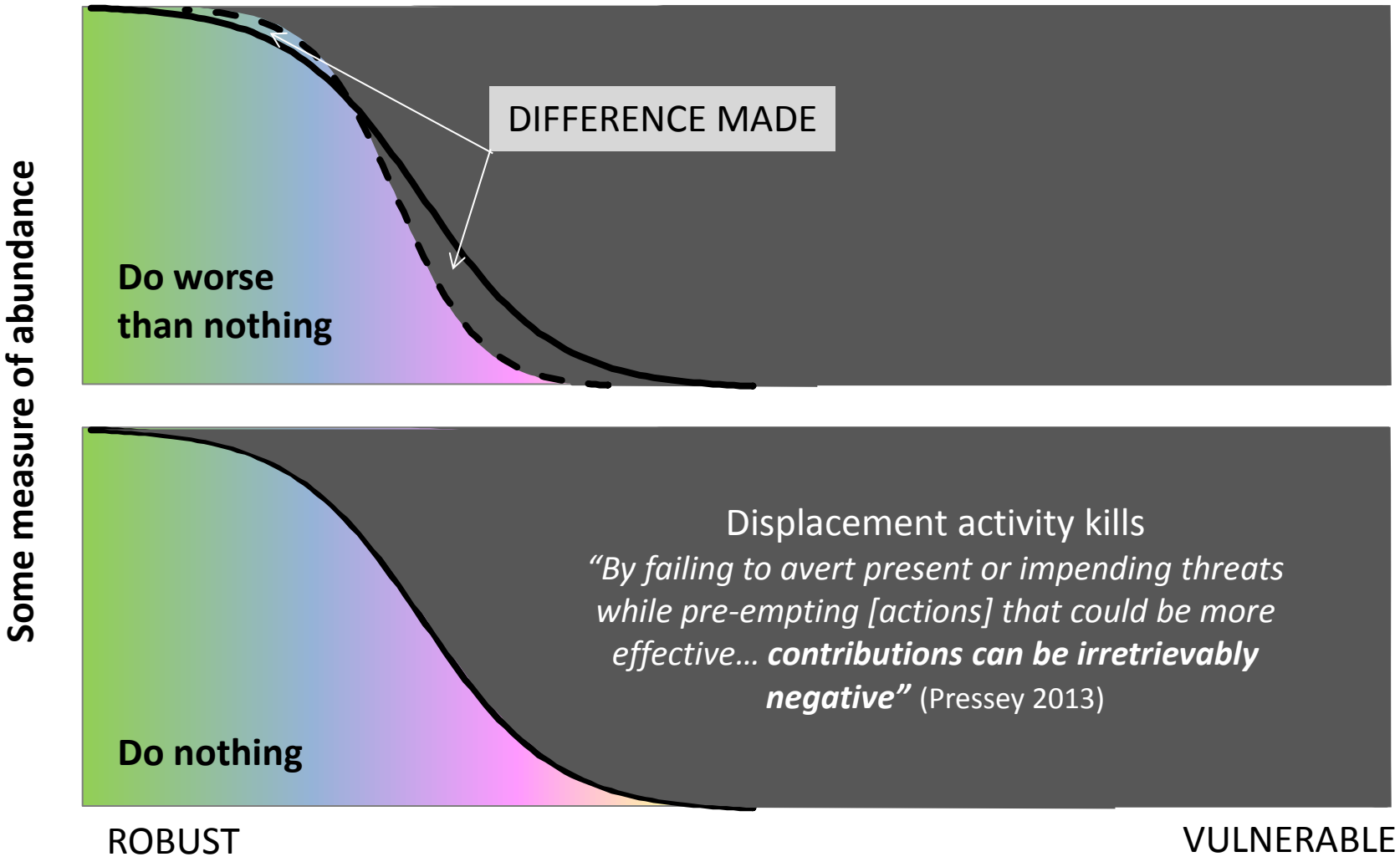
Difference is made by changing the fate of vulnerable biota



Difference is made by changing the fate of vulnerable biota

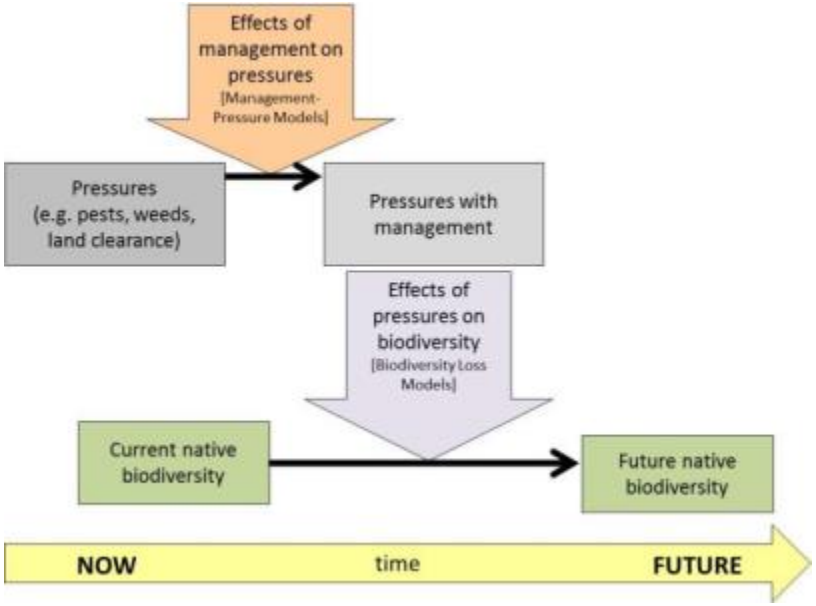


Difference is made by changing the fate of vulnerable biota



Pressey et al. 2004. Ecology Letters 7: 1035–1046; Walker et al. 2007. Conservation Biology 22: 48-59; Weeks et al. 2013. Environmental Conservation 40: 84-95

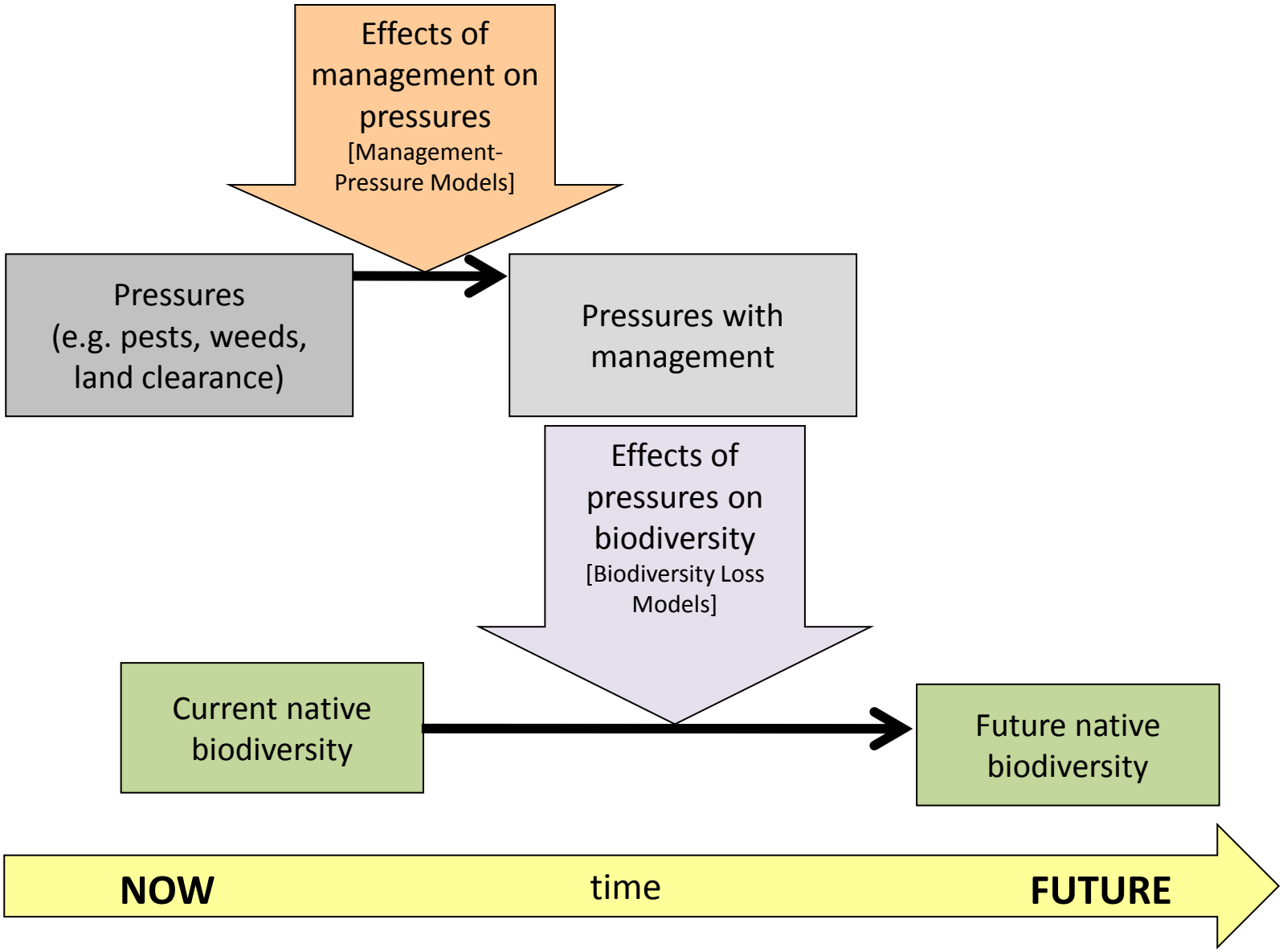
Four things you need to know



Four things you need to know

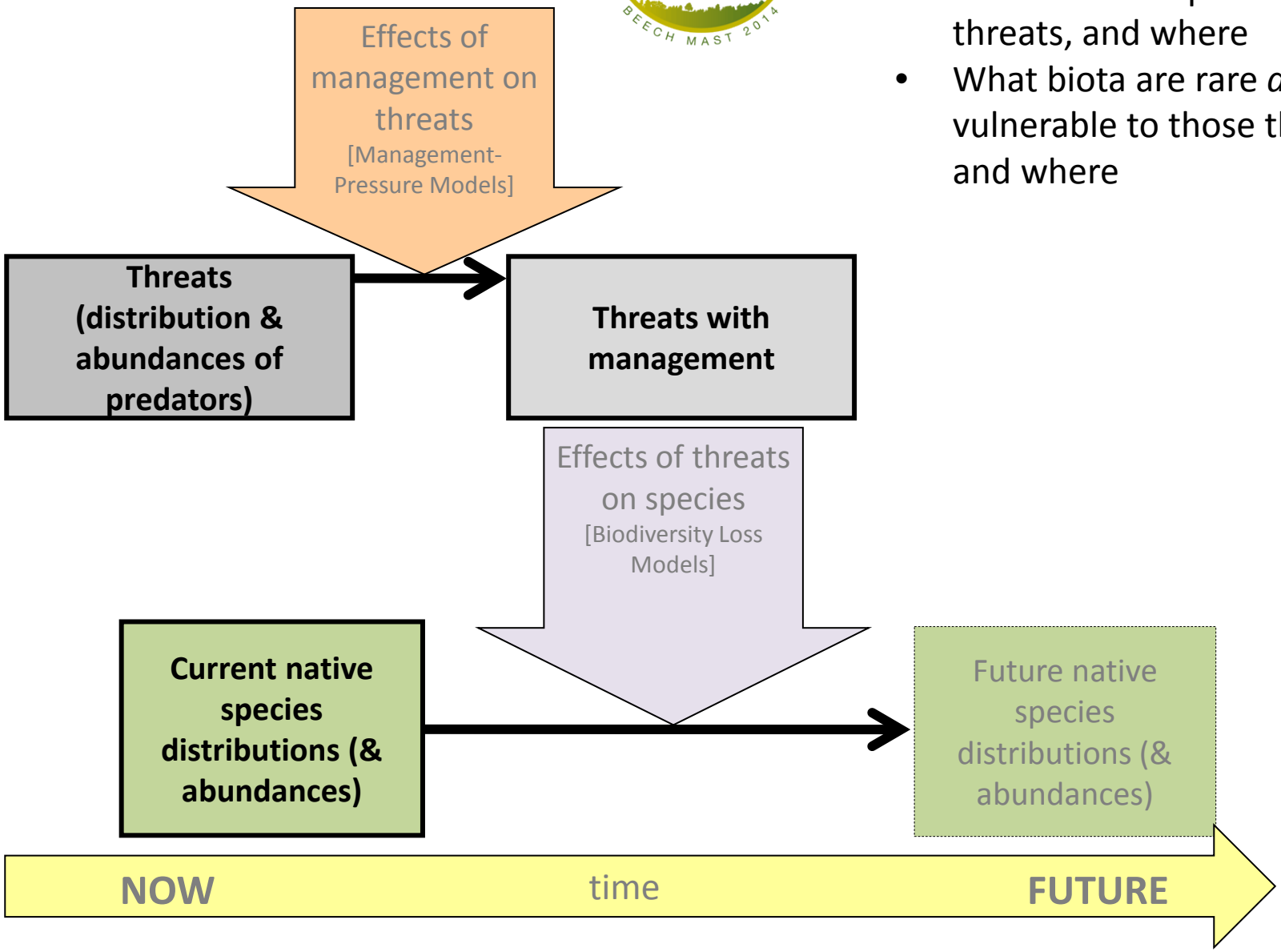
- Present and impending threats, and where
- What biota are rare *and* vulnerable to those threats, and where
- Effect of prospective management on threats
- Effects of threats (with and without management) on biota

Vital Sites & Actions general framework

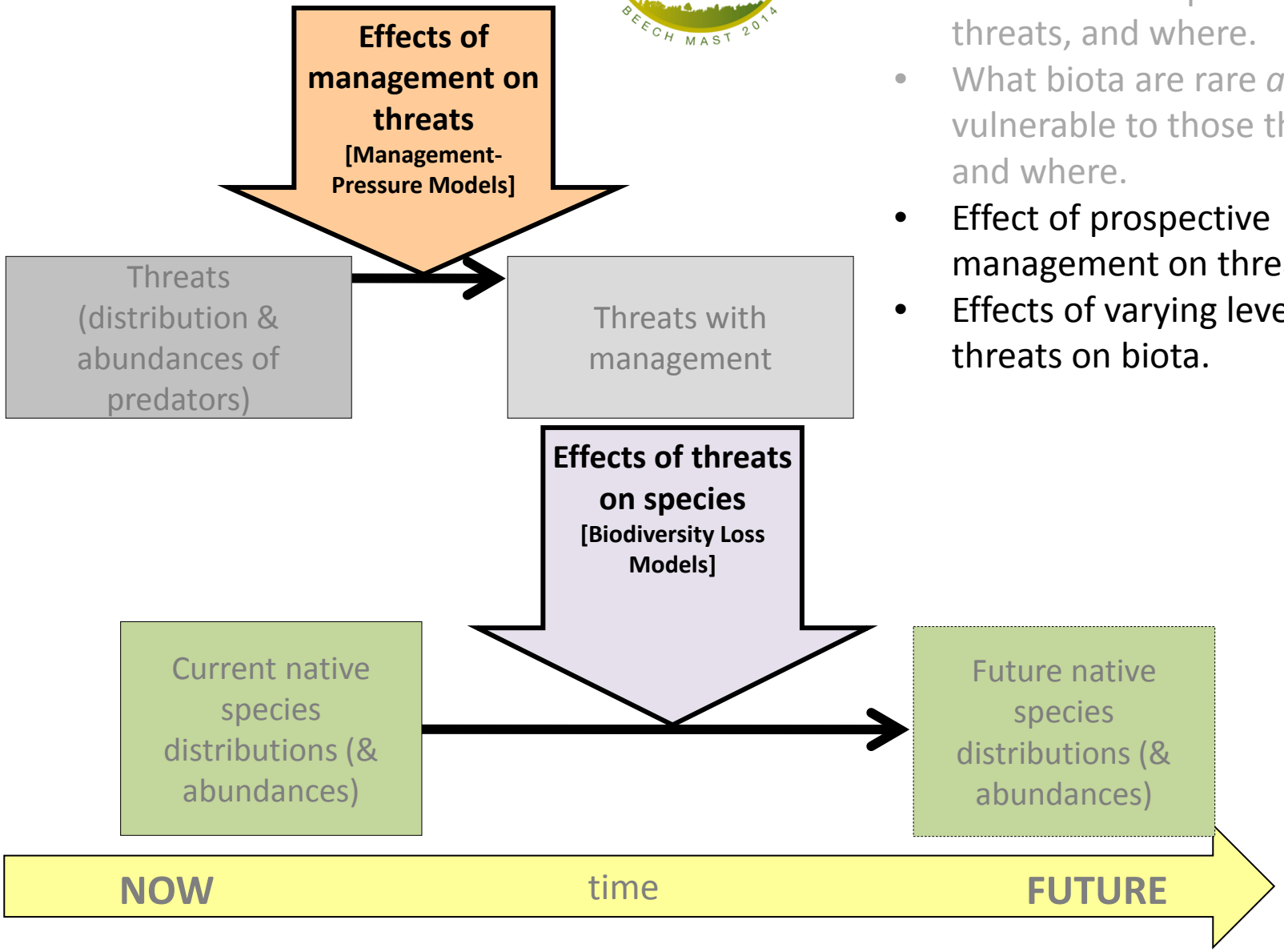


Vital Sites & Actions – a formulation

- Present and impending threats, and where
- What biota are rare *and* vulnerable to those threats, and where

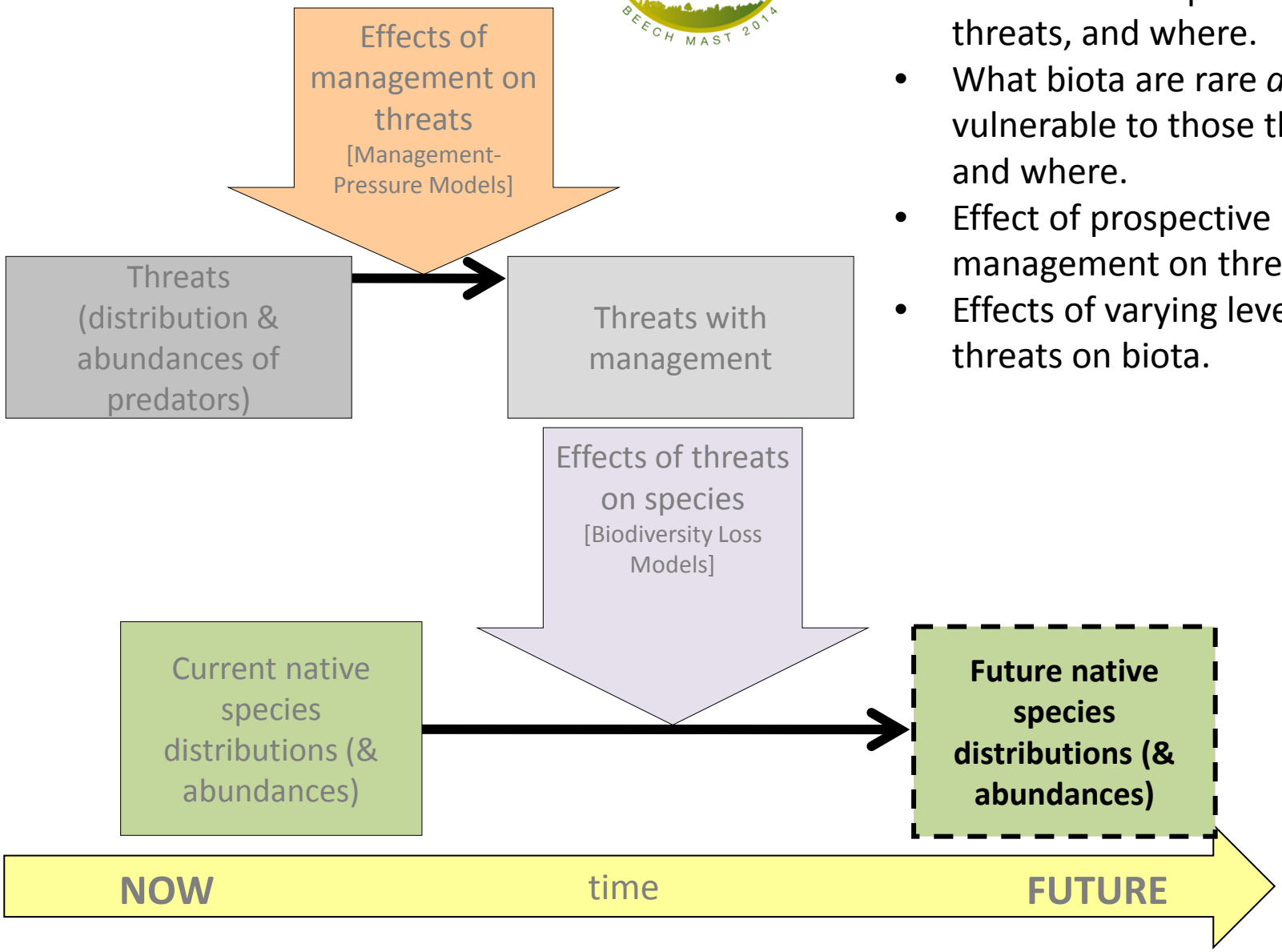


Vital Sites & Actions – a Battle for our BIRDS BEECH MAST 2014 formulation



- Present and impending threats, and where.
- What biota are rare *and* vulnerable to those threats, and where.
- Effect of prospective management on threats.
- Effects of varying levels of threats on biota.

Vital Sites & Actions – a formulation



- Present and impending threats, and where.
- What biota are rare *and* vulnerable to those threats, and where.
- Effect of prospective management on threats.
- Effects of varying levels of threats on biota.

Where it's at

Conservation Planning and Reporting using the Vital Sites Model

Jacob McC. Overton, Robbie Price, Theo Stephens, Sarah Cook, Richard Earl, Elaine Wright and Susan Walker

Diversity and Distributions, (*Diversity Distrib.*) (2015) 1–11

BIODIVERSITY RESEARCH

A Journal of Conservation Biogeography

Vital sites and actions: an integrated framework for prioritizing conservation actions and reporting achievement

Jacob McC. Overton[1]*, Susan Walker[2], Robbie Price[1], R. T. Theo Stephens[2], Sarah Henson[3†], Richard Earl[3] and Elaine Wright[3]

[1]*Landcare Research, Private Bag 3127, Hamilton, New Zealand,* [2]*Landcare Research, Dunedin, New Zealand,* [3]*Department of Conservation, Christchurch, New Zealand*

ABSTRACT

Aim We describe the Vital Sites and Actions (Vital Sites) model and computational framework for prioritizing conservation actions, describing biodiversity trends and reporting the difference made to biodiversity by conservation management.

Location We demonstrate the model in New Zealand using ecological integrity as a national biodiversity goal.

Methods Vital Sites implements a model of biodiversity, pressures on biodiversity and the benefits to biodiversity of management. Effects of pressures on biodiversity are used to predict vulnerability and future biodiversity patterns over a given time period (e.g. a decade), and management actions affect future biodiversity patterns by reducing pressures. A generalized expression of *significance* (the marginal contribution to conservation goals) is combined with vulnerability to estimate the *benefits of management* (BOM), defined as the marginal contribution to goals achieved by conservation action. Because of their dependence on biodiversity and management context, BOM is estimated relative to a defined biodiversity configuration and management scenario.

Results Conservation actions with the highest BOM are those that make the largest gains or avert the most loss to national ecological integrity. The 2009 pest control operations are predicted to decrease BOM from additional operations – even far beyond operational boundaries – because BOM depends on the expected future biodiversity configuration. National ecological integrity was predicted to decline, with the 2009 operations making only a small reduction

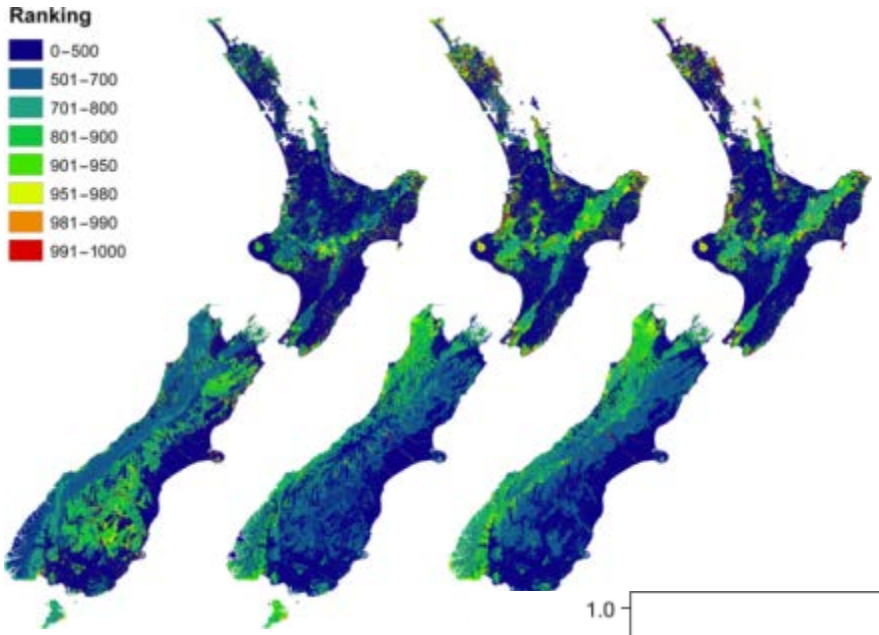
Outputs

Planning

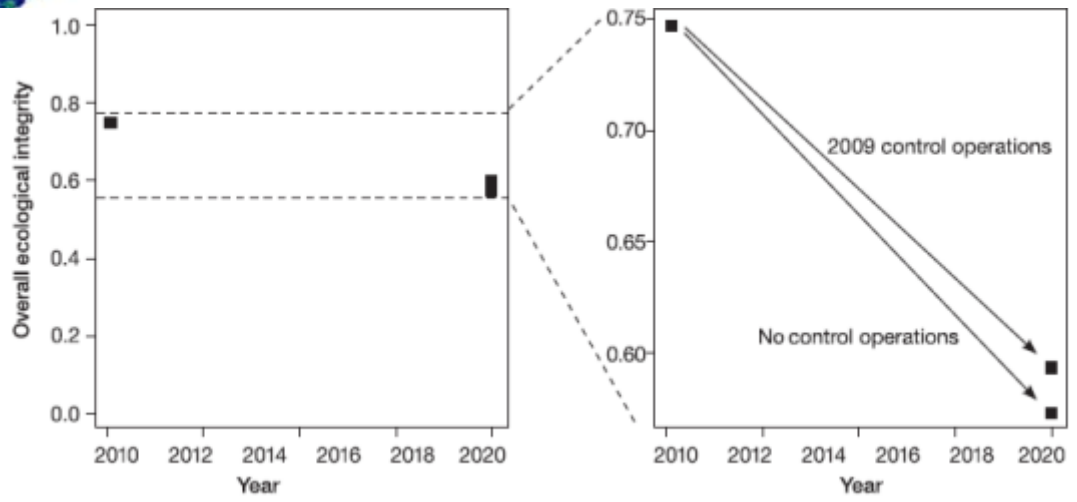
Significance

Benefits of management

Vital sites



Reporting



Inputs: identifies the essential biodiversity information for conservation action

Available on-line at: http://www.newzealandecology.org/nzje/ 243

FORUM ARTICLE

A unified approach to conservation prioritisation, reporting and information gathering in New Zealand

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Abstract: The biodiversity conservation task in
prioritisation of conservation work, informative
essential. We propose an approach to biodiversit
conservation work in New Zealand that unifies (1)
on trend and difference made to biodiversity, and (3
prioritisation and reporting are reciprocal assessme
by a common framework that links the current stat
pressures (e.g. habitat clearance, weeds and pests) a
work', e.g. legal protection, pest control, restorat
including diminishing returns, irreplaceability, and
(biodiversity change or trend) from reporting of diff
that the latter is a basis for both prioritisation and re
approach to prioritisation and reporting would hel
biodiversity inventory, monitoring and research; di
in a variety of ways, but a shared approach to gathe

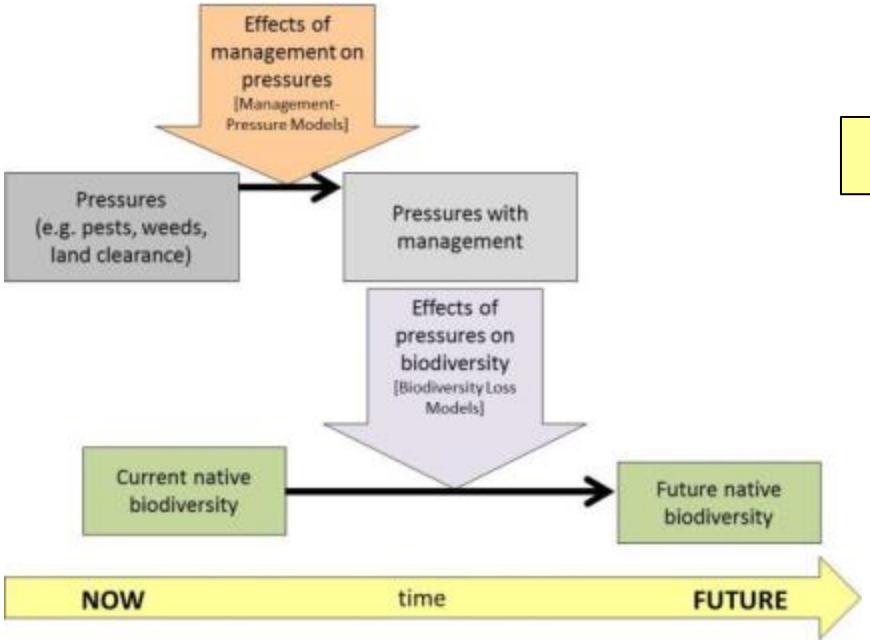
Keywords: conservation
inventory and monitoring; vulnerability

Four things you need to know

- Present and impending threats, and where
- What biota are rare *and* vulnerable to those threats, and where
- Effect of prospective management on threats
- Effects of varying levels of threats on biota

Walker et al. 2012. NZ Journal of Ecology 36: 243-251.

Journey not end point



Brings inventory, monitoring, management & research together

- Targeted inventory & monitoring for species and threats to them
- Monitoring operation outcomes
- Research and management experiments to improve models (pressure-biodiversity effects and management-pressure effects) and data
- Improved concepts and analysis methods for disparate data sources
- New spatial condition & pattern frameworks and information

etc

designed to evolve and upgrade

Information for conservation action

Effects of management on pressures [Management-Pressure Models]

Pressures (e.g. pests, weeds, land clearance)

Pressures with management

Effects of pressures on biodiversity [Biodiversity Loss Models]

Current native biodiversity

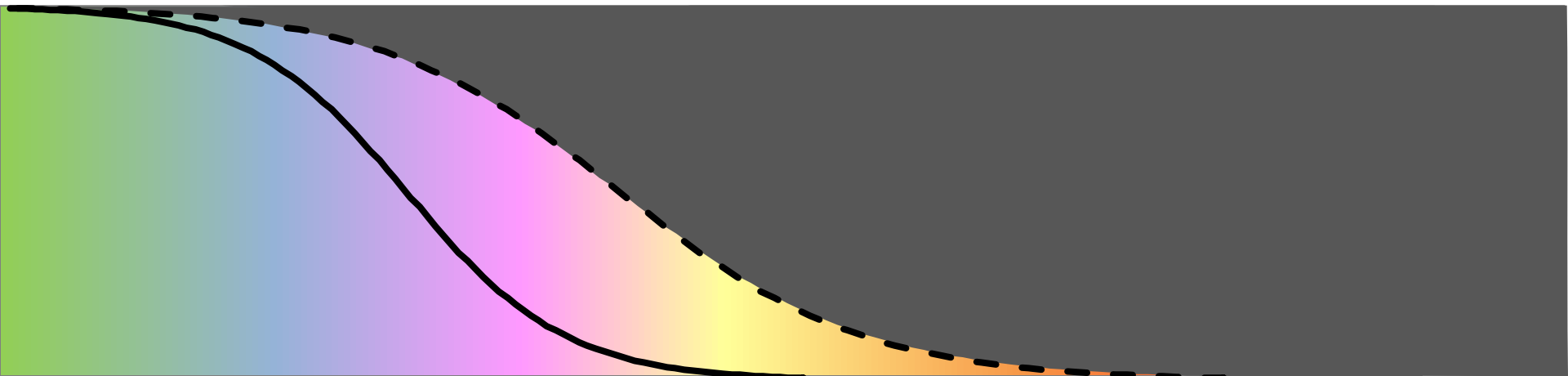
Future native biodiversity

NOW time **FUTURE**

Summing up Part 2

Information for conservation action

- Must focus on vulnerable biodiversity (and threats to it)
- Requires broader and different information than state and trend reporting, and is challenging
- Can be built over time, by multiple contributors, adding new areas of endeavour and new information



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Organisations

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