

# Testing a climate adaptation strategy for vulnerable seabirds



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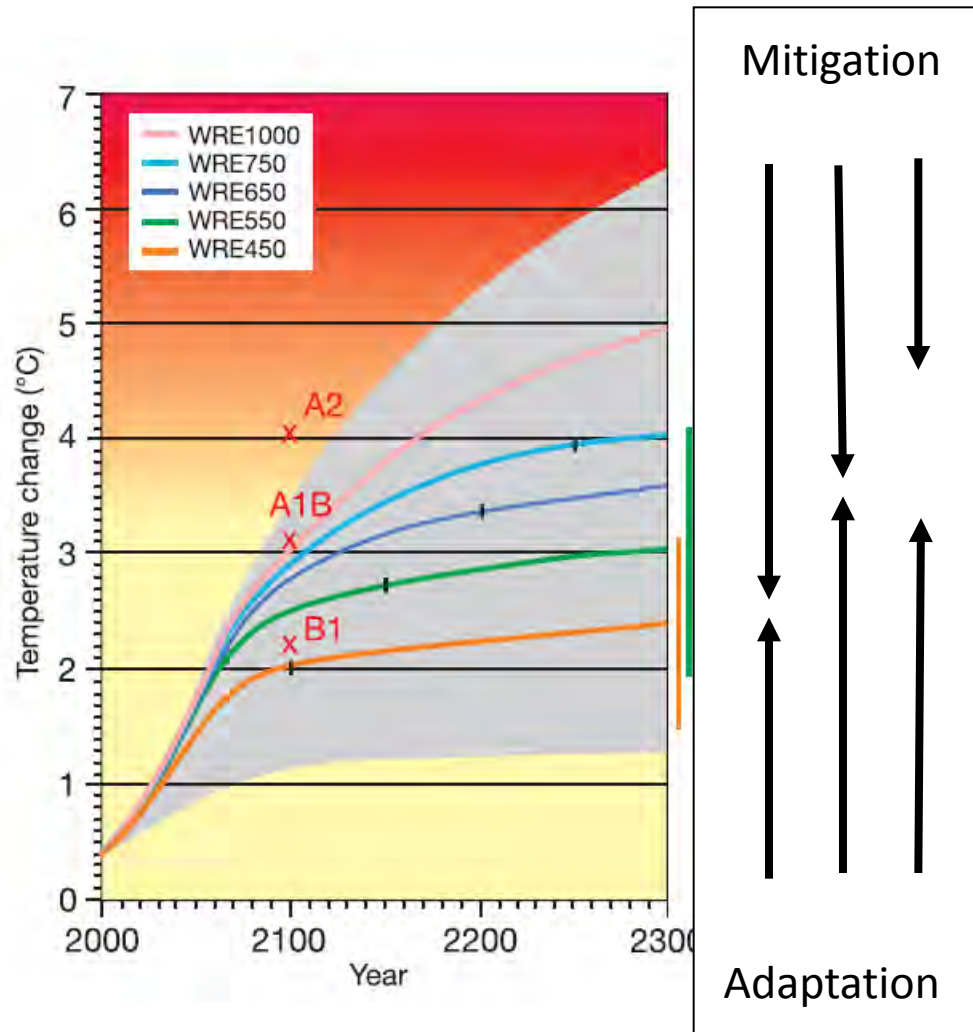
# IPCC, Marine Report Cards, etc



- Physical
  - Temperature
  - Sea Level
  - East Australia Current
  - Leeuwin Current
  - ENSO
  - Ocean Acidification
- Biological
  - Microbes
  - Algae
  - Seagrass
  - Mangroves and tidal wetlands
  - Phytoplankton
  - Zooplankton
  - Pelagic fish
  - Coral reefs
  - Tropical fish
  - Temperate fish
  - Marine reptiles
  - Seabirds
  - Marine Mammals

<http://www.oceanclimatechange.org.au>

# Climate change - disrupting natural systems first



# Putting adaptation into action

- Understand challenge
- Develop a range of options
- Prioritize these options
- Initiate “demonstration” projects
  - supporting people
  - supporting species

# Some proposed adaptation options will be “novel”

COMMENT

## Bring elephants to Australia?

There's a solution to the continent's rampant fires and feral animals, says David Bowman — introduce large mammals and increase hunting pressure.

Three years ago this week, Australia was burning. On 7 February 2009 — now known as Black Saturday — a massive firestorm consumed more than 400,000 hectares in southern Australia. At least 173 people died trying to outrun the fires, defend their homes or seek shelter.

That blaze was unusually fierce, but fires are a constant source of anxiety for Australia. The continent is extremely fire-prone, with a distinctive signature of oscillating fire activity that begins in the north during the winter, then moves south during the summer. Lately, the fires have been more intense and widespread, perhaps as a result of climate change — last year, around 5% of the continent was burnt.

If only fires were Australia's sole environmental concern. The continent is also overrun by invasive species. They fill holes created by a mass extinction event that occurred around 50,000 years ago during the Pleistocene, when the arrival of the first Australians coincided with a collapse in the continent's megafauna, namely giant marsupials (some as large as hippos), reptiles and birds<sup>1</sup>. The precise causes of that event are unclear, but the resulting gap in the food web has been filled by populations of pigs, goats, cattle, horses, donkeys, camels, buffalo and deer<sup>2</sup>. These animals are reconstructing ecosystems, a trend amplified by the introduction of alien plants, particularly

I accept that this is a radical way of thinking; we would have to weigh the various options. For example, we could stop poisoning the Australian wolf (dingo). Poisoning disrupts their social structure, and research suggests that dingoes in packs act as top predators of smaller predators such as introduced foxes<sup>3</sup>. More dingoes could also help to control other feral animals, such as



pigs. Alternatively, we could introduce

control gamba grass involve using chemicals or physically clearing the land, which would destroy the habitat. Using mega-herbivores may ultimately be more practical and cost-effective, and it would help to conserve animals that are threatened by poaching in their native environments. This potential solution is not limited to Australia — it has been suggested that elephants could be used as part of a project to 'rewild' or return North American ecosystems to their prehuman state<sup>4</sup>.

I realize that there are major risks associated with what I am proposing. It would be essential to proceed cautiously, with well-designed studies to monitor the effects. The greatest challenge would be managing the density of herbivore populations so that their demand on resources does not degrade the ecosystem. Here, we could adopt management methods from game parks and reserves, such as building fences, regulating the availability of water and food, and controlling breeding and hunting.

Of course, introducing large mammals cannot solve all of Australia's ecological-management conundrums. And I am mindful that the proposal could be used to justify commercial grazing in fragile ecosystems, an ongoing controversy<sup>5</sup>. But the usual approaches to managing these issues aren't working. The full spectrum of options needs to be canvassed in an open and honest way. ■

A. LIPMAN/ISTOCK



# Outrage!

DEPENDENCE COMMENT

but they are based on a sound ecological understanding. Richard J. Hobbs University of Western Australia, Crawley, Australia. richard.hobbs@uwa.edu.au

### Australia: a case for Aboriginal rangers

David Bowman makes a strong case for employing Aboriginal people to manage their own land and to reinstate traditional fire practices in Australia (Nature 482, 30, 2012). This strategy could form the basis of a coordinated, long-term conservation service.

It would also provide desperately needed employment for indigenous people, as well as supplying them with a reliable source of protein from hunting feral animals (S. Collier et al. Hum. Ecol. 36, 135–164, 2011). In addition, the Aboriginal people, who have a deep spiritual connection to land, would be able to maintain their traditional territories and to maintain close functional relationships with their ancestors.

### no price on cutting fire risk

David Bowman proposes that elephants should be introduced to Australia to control invasive gamba grass, a major source of wildfire fuel (Nature 482, 30, 2012), but managing the elephants could be more expensive than, say, installing a fleet of harvesters every year to reduce the risk. We should start by asking what is likely to work best, regardless of the cost.

To control the problems caused by invasive alien, we should implement ecologically sound control mechanisms that have a reasonable probability of success. We can worry about the bill later. P. J. Moore-Bryant, Andrew B. Densley University of Pretoria, Hatfield, South Africa. pjd@hmgecology.up.ac.za



### Sugar: a problem of developed countries

The contribution of sugar to cardiovascular disease is more relevant to developed countries than to the developing world (Nature 482, 27–29, 2012). In Asia, for example, up to 10% of the population is obese and/or diabetic (see go.nature.com/qsu6m4). Though the risk of cardiovascular disease from sugar is less than that from saturated fat, it is high compared with other diet-based diseases. In Asia, the consumption of refined sugar has increased rapidly in the past few decades. Overconsumption of foods that have a high glycaemic index (that trigger a rapid and sharp increase in blood glucose), such as wheat, potato and corn, may in fact also contribute to obesity and diabetes. Emphasis on sugar intake is therefore far narrower a basis for deriving policies to curb these problems.

### Australia: small steps to control invasives

We believe that there are more obvious and less destructive options for controlling gamba grass and other invaders in Australia than introducing mega-herbivores such as elephants (Nature 482, 30, 2012).

### Sugar: other 'toxins' factors play a part

Regulating products based on a clear risk analysis is a worthy goal, but I understand that Robert Lustig has no ecological

### oversimplify the "toxic" truth about refined carbohydrates

The authors also deny that other complex factors that could contribute to socio-economic disease burden. These include relatively recent changes in the social and cultural environment. Further, sugar is not a toxin. It is a nutrient. It is not a behavioral modification, nor do they have the second-hand predatory impact of tobacco smoking — key factors in their respective epidemics. S. Islam H. All University of Vermont, Burlington, USA. sislam@uvm.edu

### Australia: better solutions to wildfires

Among David Bowman's more useful suggestions for dealing with Australia's severe problems of wildfires, flood damage and weeds, there are more obvious and less destructive options for controlling gamba grass and other invaders in Australia than introducing mega-herbivores such as elephants (Nature 482, 30, 2012).

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But, novel conversations are important....need maturity to have them

# New management perspectives

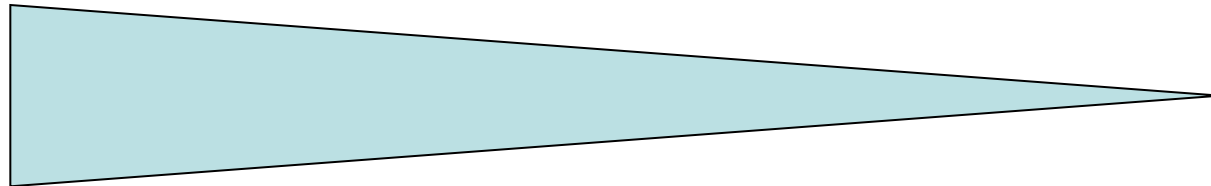
- What you manage today won't be what you manage tomorrow
  - Regional loss of individual species inevitable under climate change – does not have to mean extinction
- Move from “preserve and protect” to “facilitate change”
  - Intervention = directed adaptation
- Moving from a species-focus to an ecosystem services approach
  - But, don't forget the species...

# Natural system managers under climate change?

“curators”                      “ecologists”                      “analysts”                      “engineers”

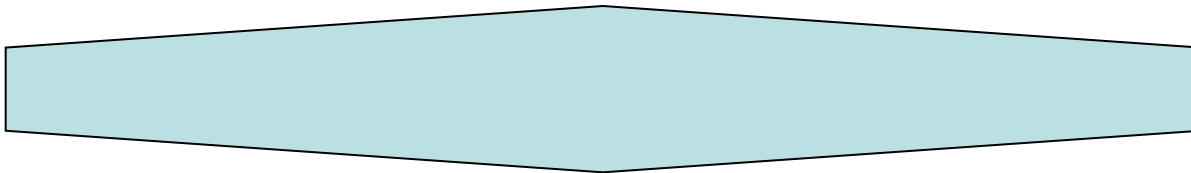


**Now**



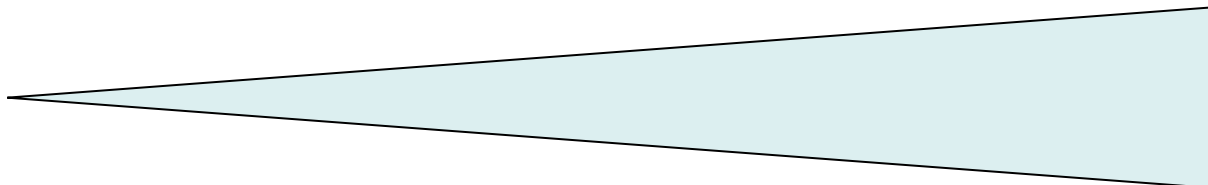
Objectives not needed....”preserve and protect”

**Medium-term**



Objectives become very important – what do we want?

**Long-term**



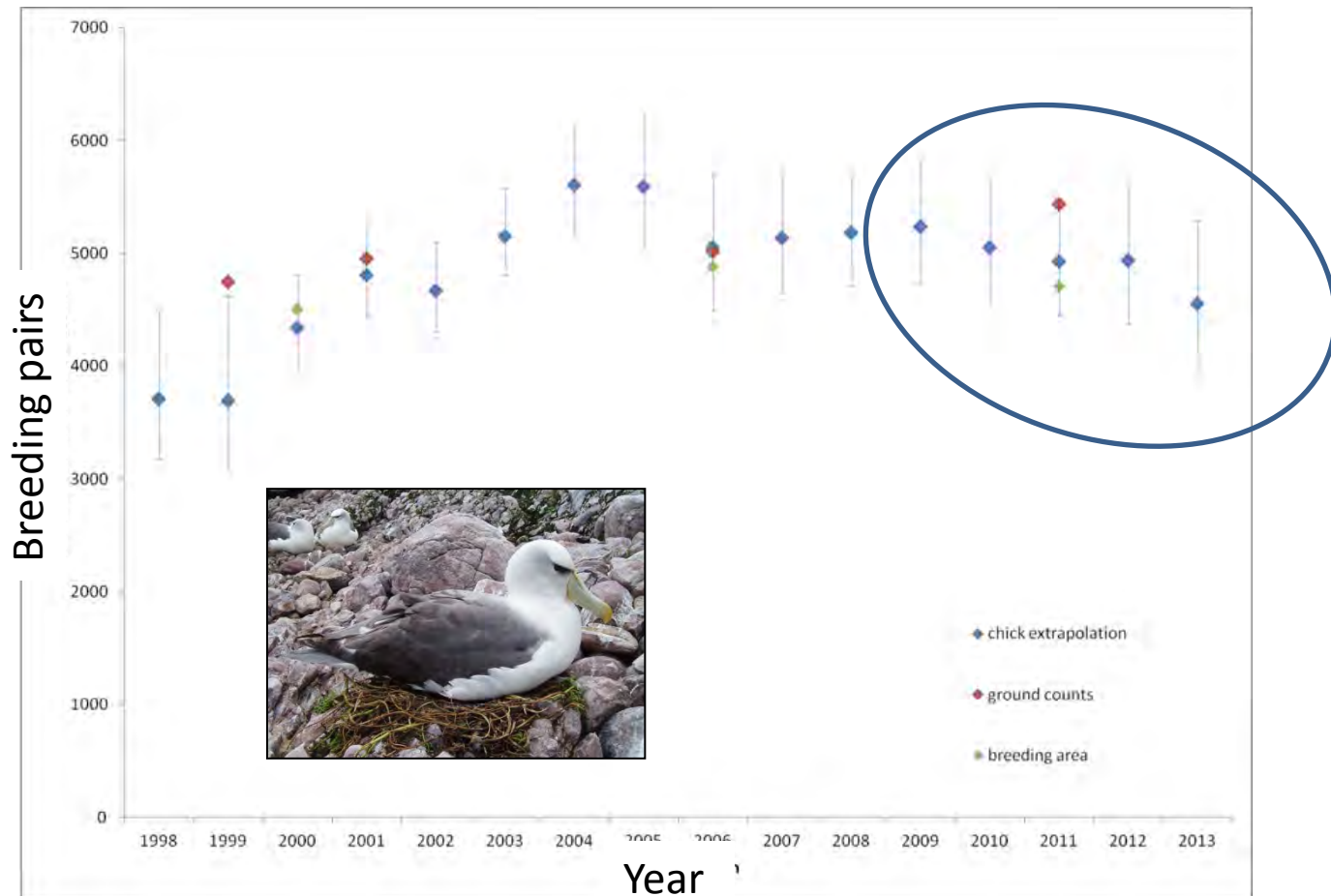
# Shy albatross – endemic to Australia





# Albatross Island

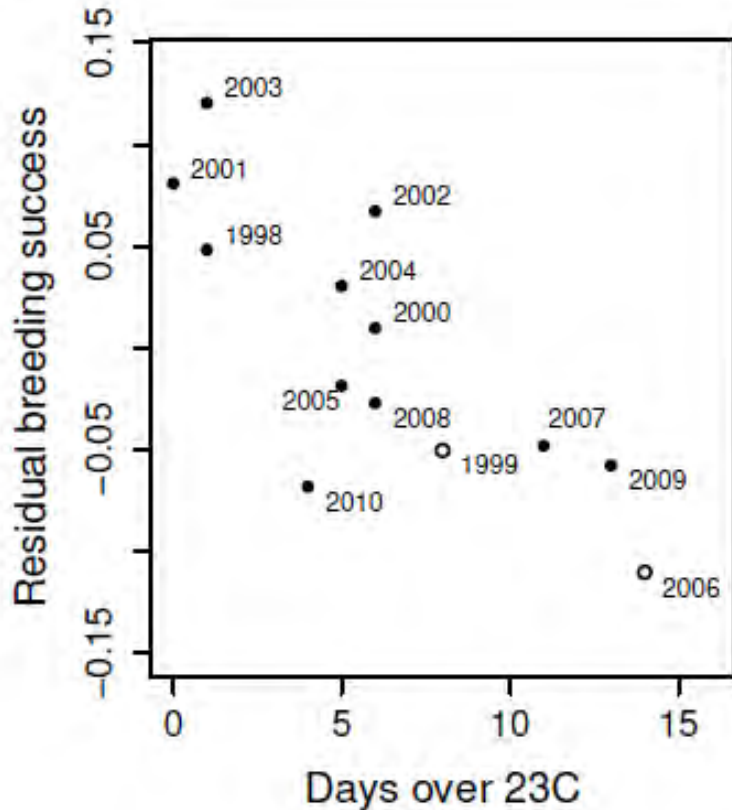
- Population size appears to be declining....



# Clear climate signal

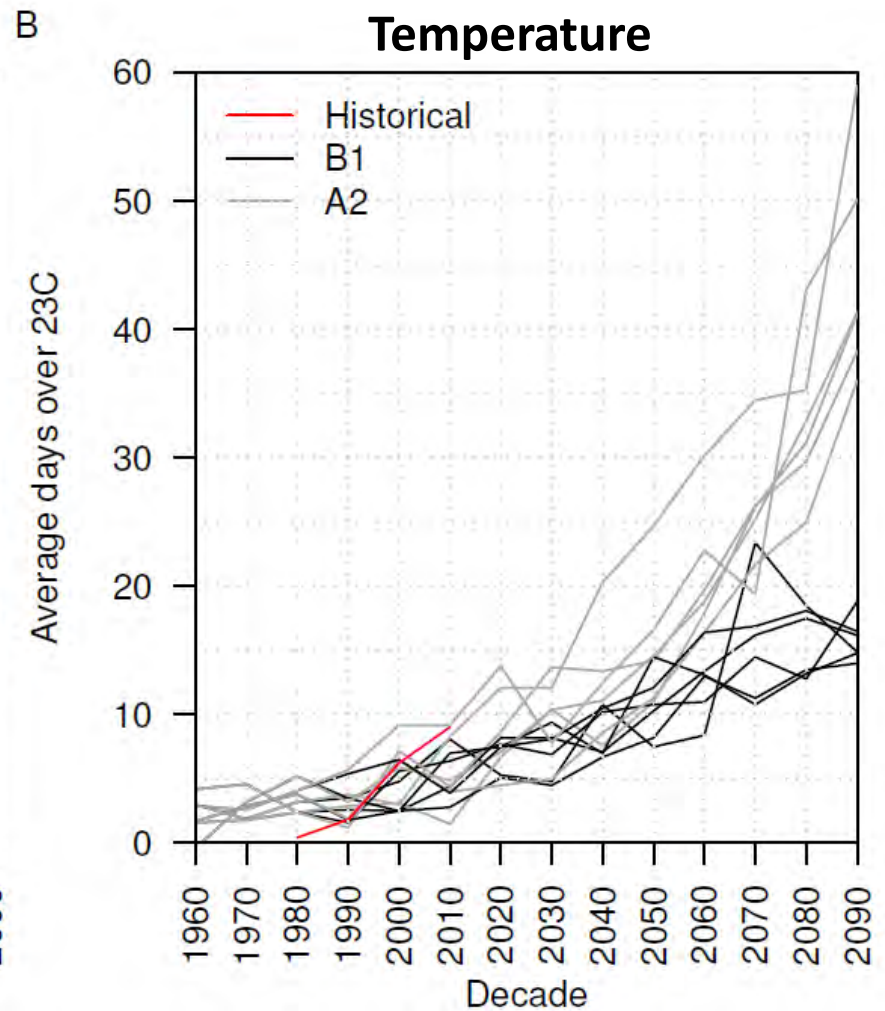
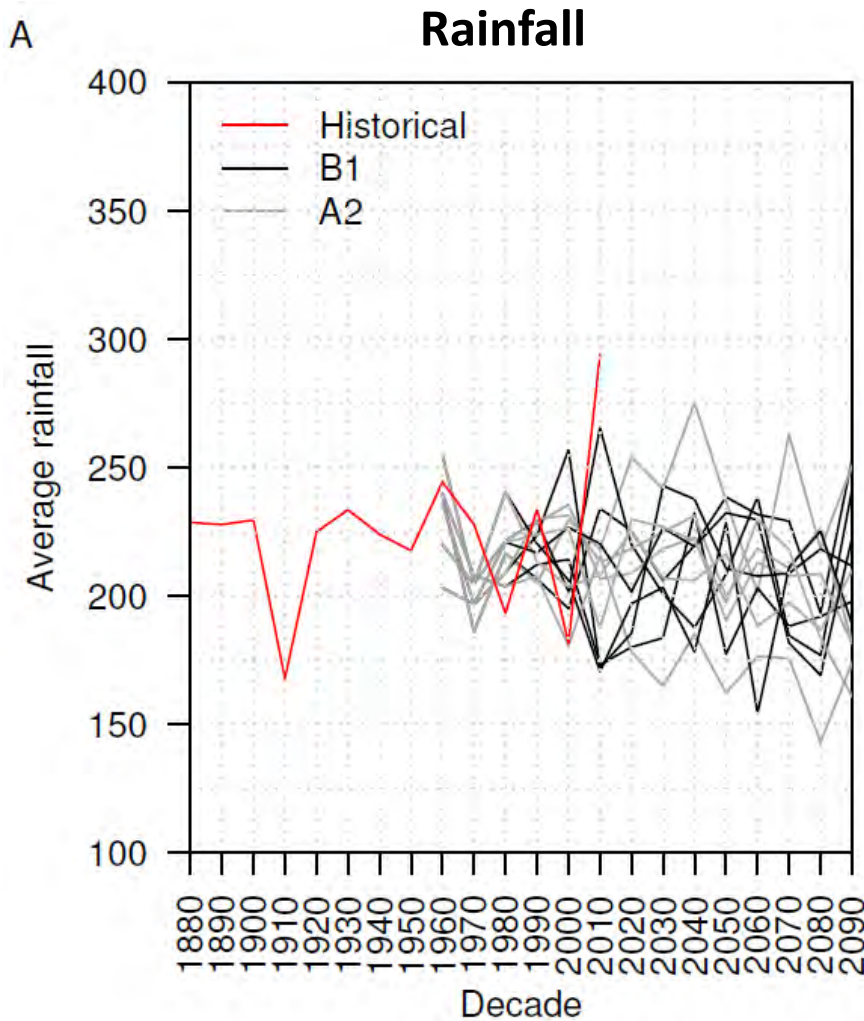
- Breeding success declines with temperature

C

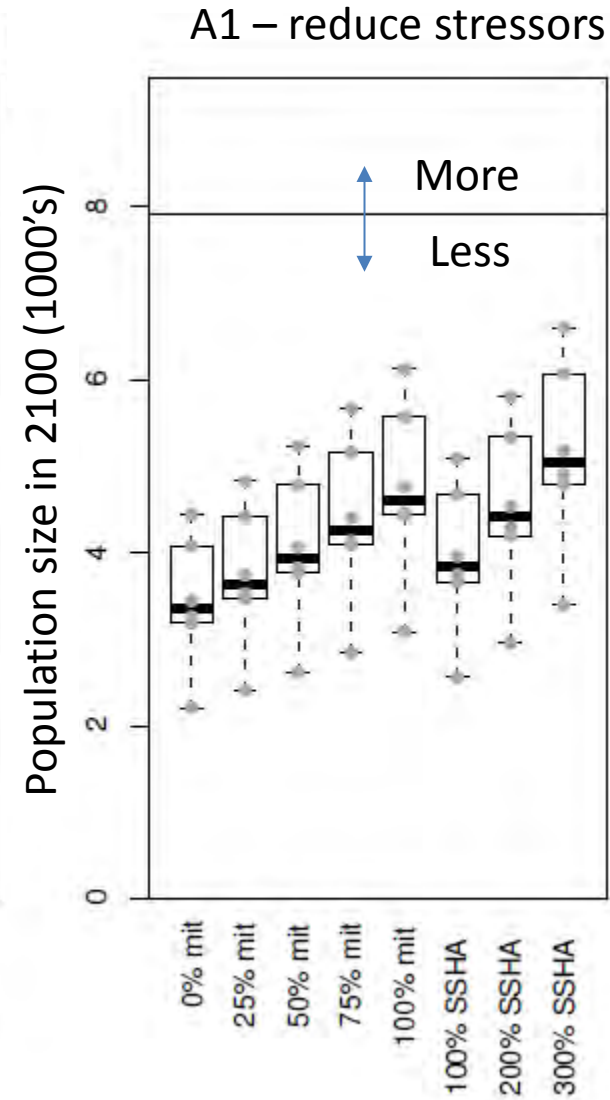
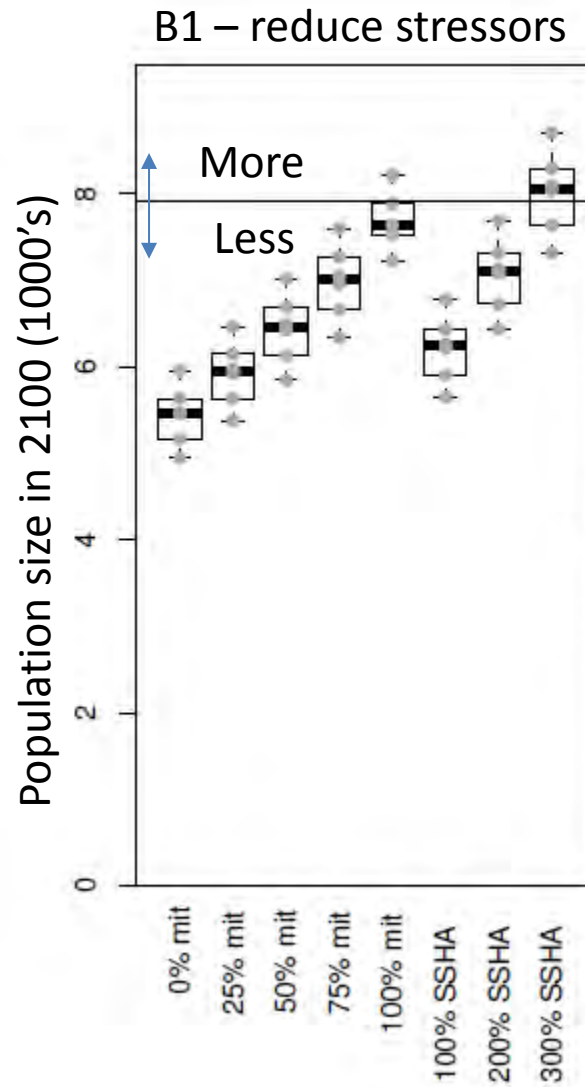
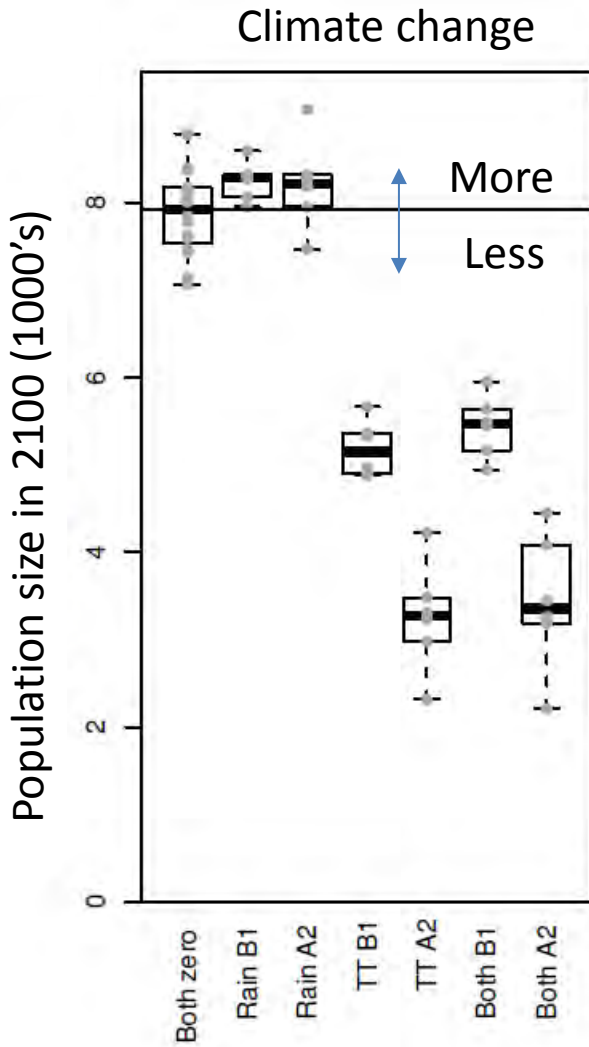


Thompson et al, in review

# Future environment will be warmer



# The future for Shy Albatross - fewer



# Managers need adaptation options

Generate and evaluate adaptation options

Rapid assessment (SAPS tools)

<b>Implementation of successful adaptation requires options that are</b>	<b>“Responsible” group</b>	<b>Tools to assess options</b>
Generate options	Scientists and managers	1. Vulnerability framework
Technically appropriate	Scientists and managers	2. Cost-benefit-risk
Institutionally possible	‘Policy & management’	3. Barriers analysis
Socially acceptable	Citizens	4. Social acceptability

# Generate adaptation options

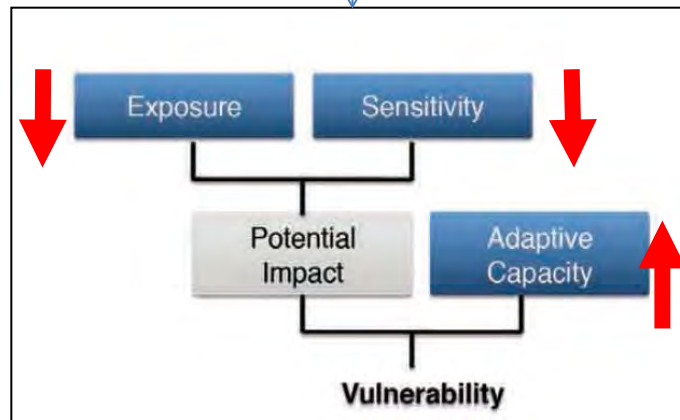


Implementation of successful adaptation requires options that are	"Responsible"	Tools to assess options
Generate options	Scientists	1. Vulnerability framework
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Institutionally possible	'Policy & management'	3. Barriers analysis
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## Reduce exposure

(avoid climate)

- Translocation
- Habitat modification
- Shading
- Engineering



## Reduce sensitivity

(improve condition)

- Supplemental feeding
- Habitat modification
- Disease treatment

## Increase adaptive capacity

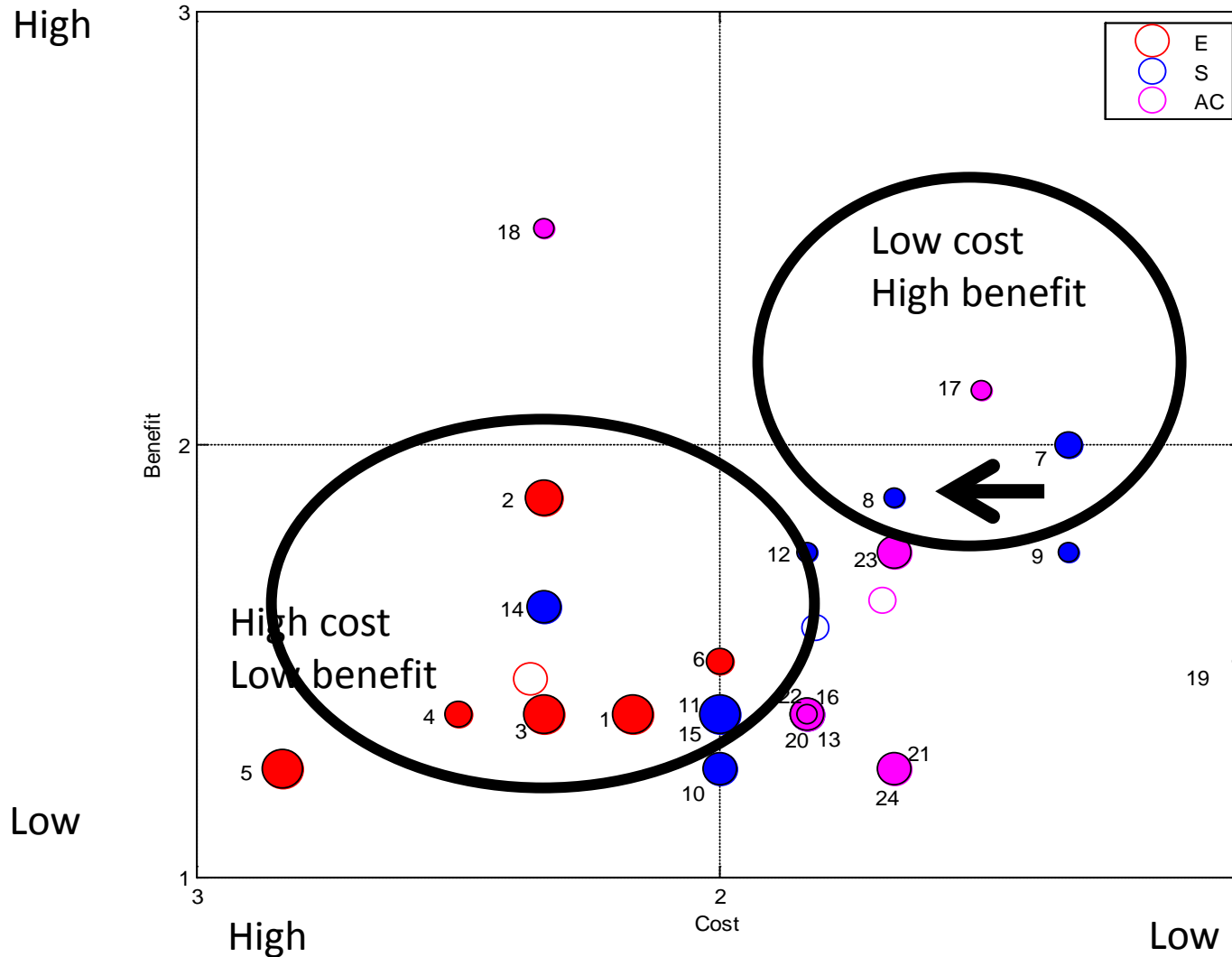
(reduce other stressors)

- Reduce bycatch
- Pest eradication
- Predator management

# Cost-benefit-risk tool

## 24 options

Implementation of successful adaptation requires options that are	"Responsible"	Tools to assess options
Generate options	Scientists	1. Vulnerability framework
Technically appropriate	Scientists	2. Cost-benefit-risk
Institutionally possible	Policy & management	3. Barriers analysis
Socially acceptable	Citizens	4. Social acceptability



# Selected an adaptation strategy

Enhance chick survival via disease reduction

- Warmer temperatures
  - > increase parasite load
- Reduce parasite load
  - > increase survival?
- Institutional approval
- Risk assessment
- Public comment
- Ethics approval



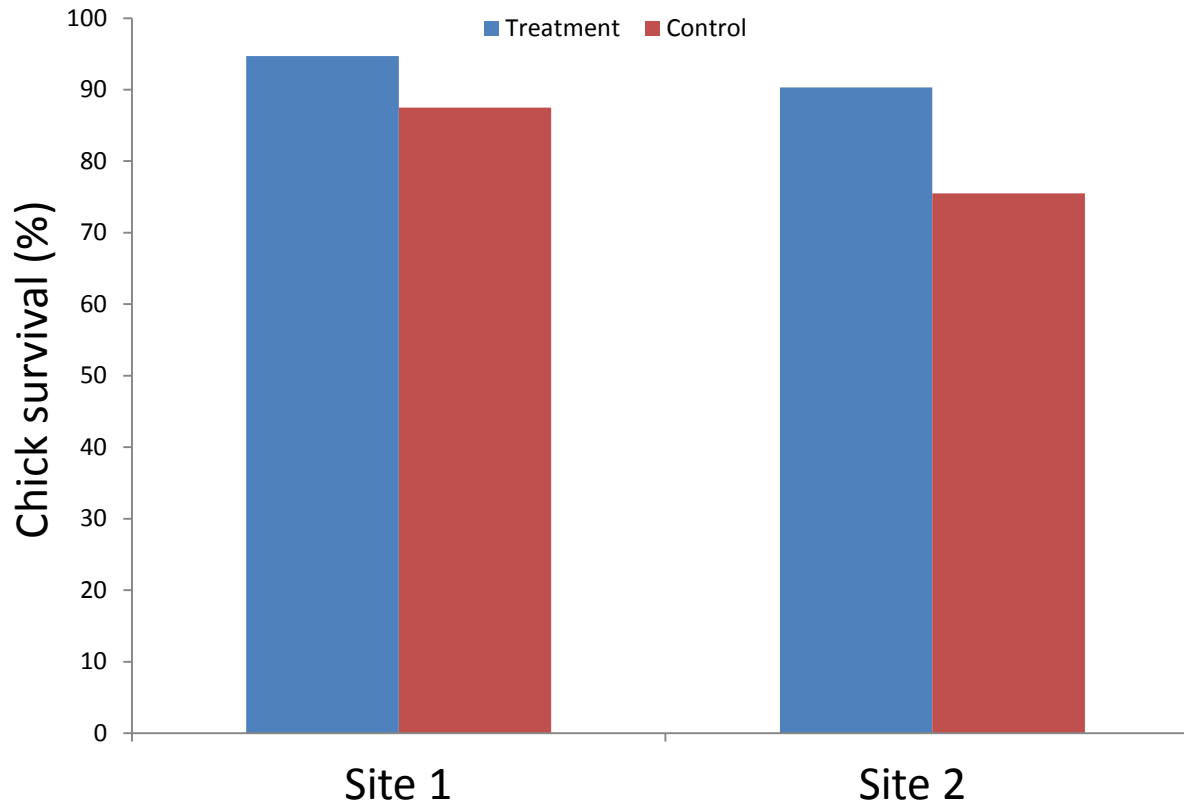
# Selected an adaptation strategy

Enhance chick survival via disease reduction

- Tested in February 2014
- Treatment (2) and control plots (~50 birds in each)

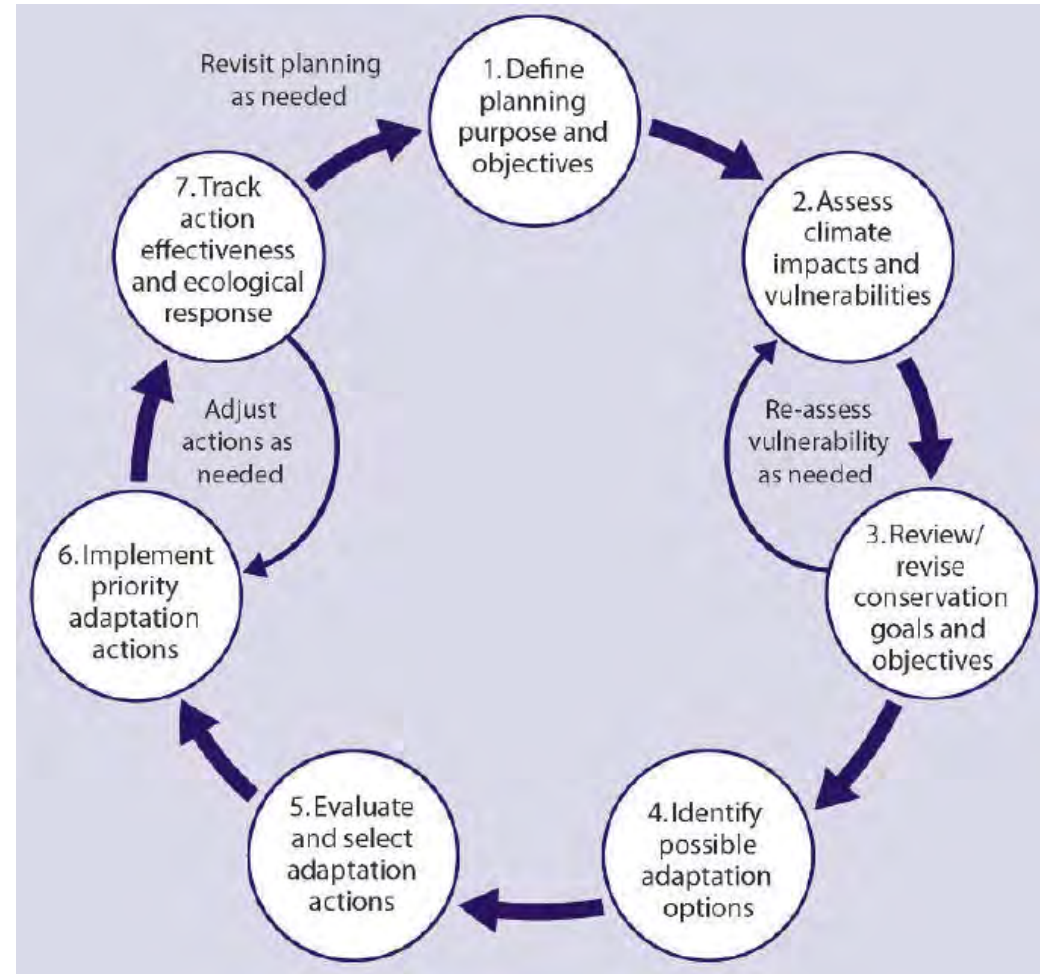
# Chick survival 10% higher with intervention

(after 6 weeks)



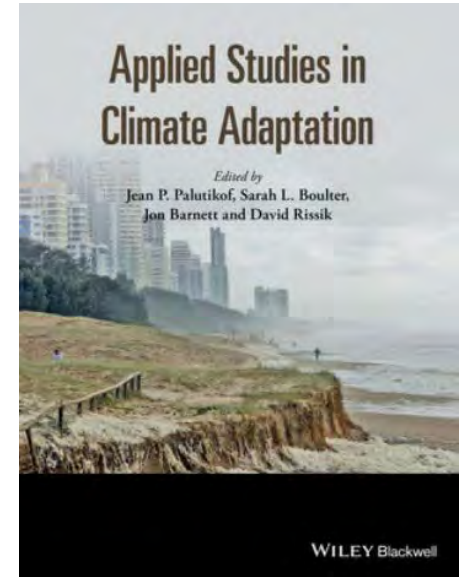
# Adaptation “process” established

- A climate adaptation response (intervention) tested
  - Process formalised with the conservation agency
- Continue to plan adaptation responses for this and other species, habitats, ecosystems
  - Important to test, learn, and refine (adaptive) management under climate change



# Next steps - albatross

- Test more options
  - Build a tool bag of options
    - We will learn!
- Implementation strategy
  - When would you do this “for real”?
  - Forecast breeding season environmental conditions
    - Warm-wet seasons -> disease increases – treatment
    - Cool – dry seasons -> less effect – another option



# Threatened species in Australia

- Australia has 96 critically endangered animal species, as listed by the IUCN
- Threatened species recovery plans (Nov 2009)
  - Action underway
    - 470 plans
  - Action not underway
    - 707 plans



# Iconic Australian Species

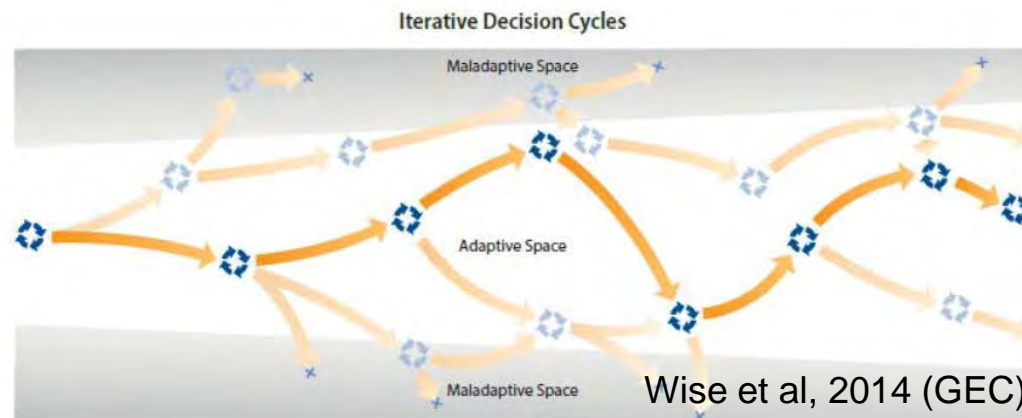


John Gould paintings from the Australian Museum

# Lessons learned

Putting conservation adaptation into action

- Develop a range of options, in partnership
- Prioritize these options (e.g. SAPS)
- Initiate demonstration *in situ* projects
- Develop an adaptation pathway for long term planning



# Career progression

Impacts

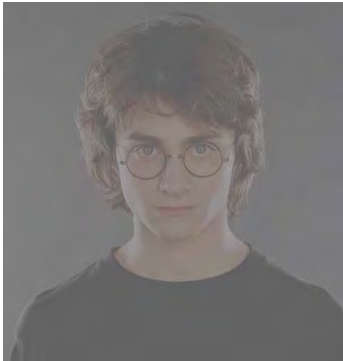
“see”

Attribution

“why”

Adaptation

“what to do”



Science



Management/Policy

<40 yrs.

40-60 yrs

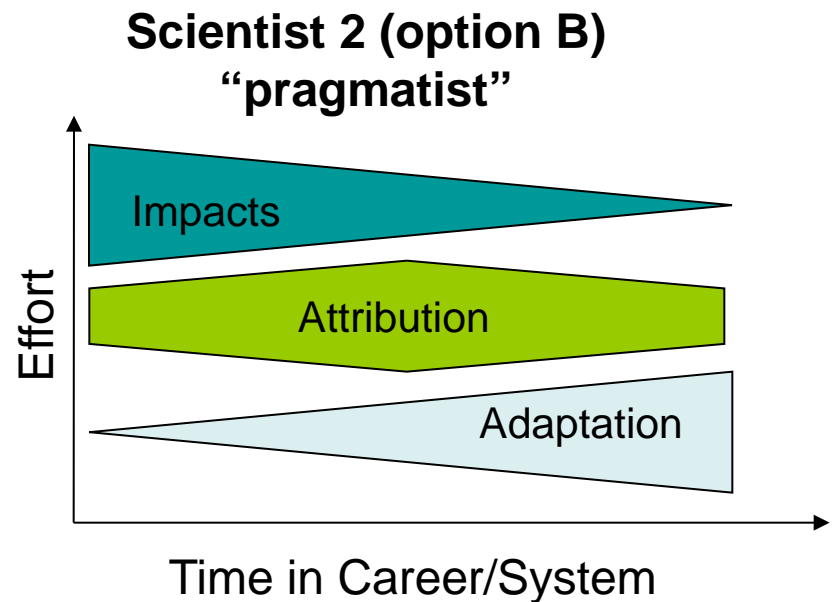
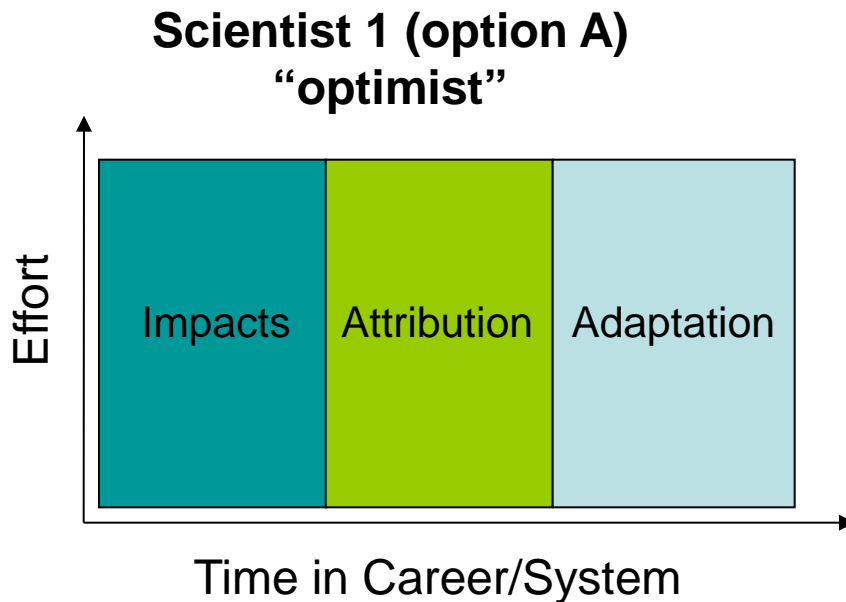
50-65 yrs.

Few years left....

How can we speed this up?

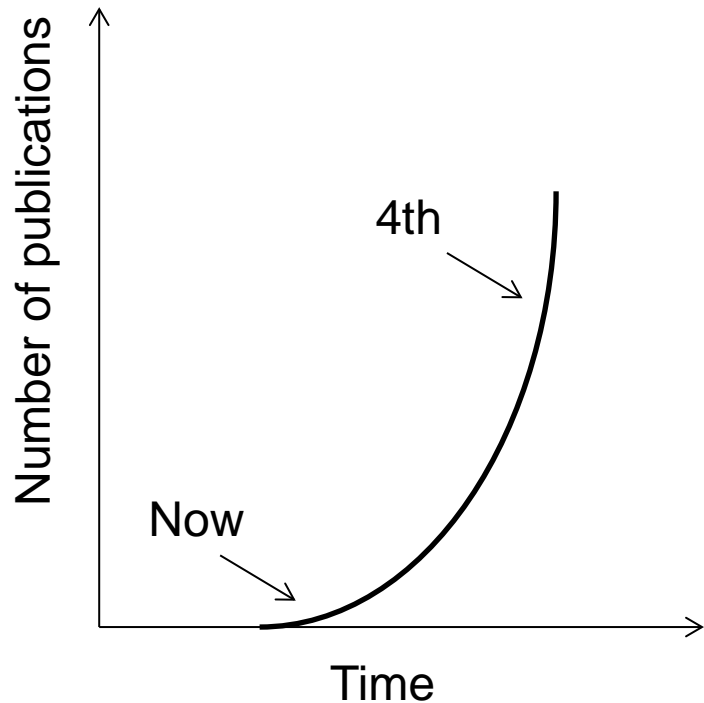


# What kind of scientist will be useful under climate change?



# And put some effort into it!

Publications over time



$H_0$  = Recruitment to science (grad students)

$H_1$  = Recruitment to this topic (stampede)

# Monitoring is important - learning

## Methods in Ecology and Evolution



*Methods in Ecology and Evolution* 2015

doi: 10.1111/2041-210X.12339

### **A high-resolution panorama camera system for monitoring colony-wide seabird nesting behaviour**

Tim P. Lynch<sup>1\*</sup>, Rachael Alderman<sup>2</sup> and Alistair J. Hobday<sup>1</sup>

Lynch et al 2015 - Table of image URLs

e.g. [www.gigapan.com/gigapans/142356](http://www.gigapan.com/gigapans/142356)

# Climate adaptation for natural systems is challenging – but don't waste time

1. Be innovative – develop, prioritize and test adaptation
2. “New” scientists working with “new managers”
3. Learn a lot by practising – need enhanced monitoring

