Testing a climate adaptation strategy for vulnerable seabirds

Alistair Hobday and Rachael Alderman

CSIRO, Australia

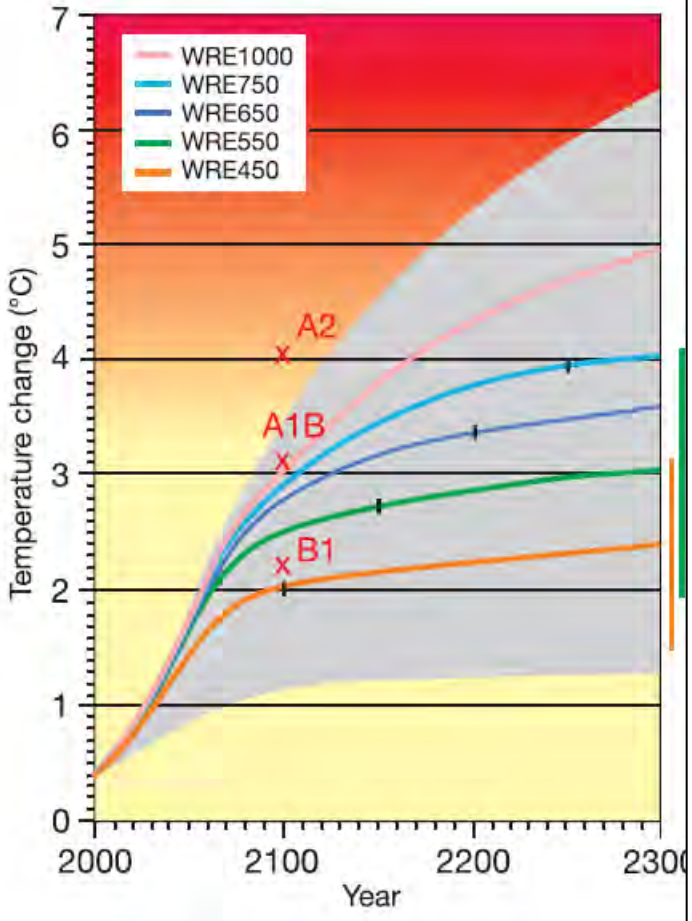
Department of Primary Industries, Parks, Water and Environment,

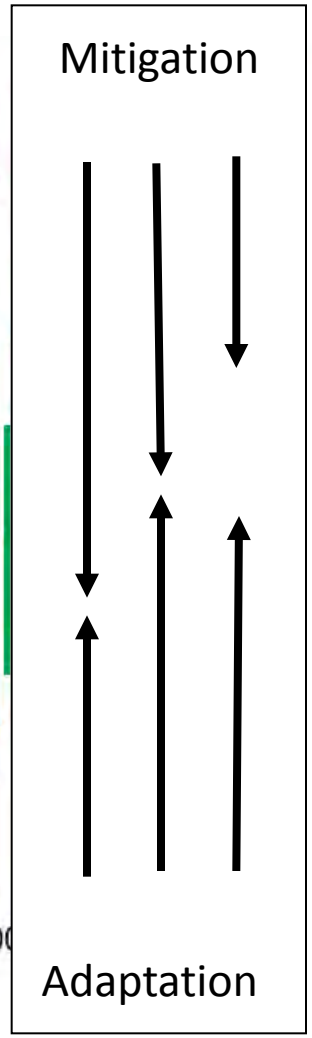
IPCC, Marine Report Cards, etc

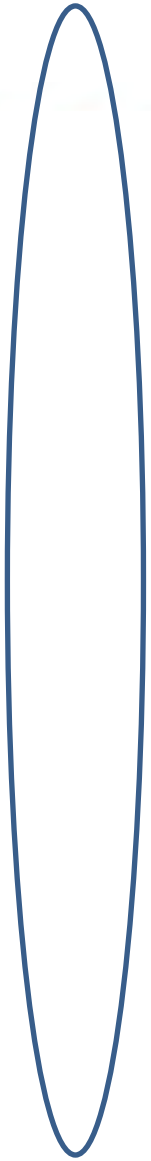
- Physical
  - Temperature
  - Sea Level
  - East Australia Current
  - Leeuwin Current
  - ENSO
  - Ocean Acidification
- Biological
  - Microbes
  - Algae
  - Seagrass
  - Mangroves and tidal wetlands
  - Phytoplankton
  - Zooplankton
  - Pelagic fish
  - Coral reefs
  - Tropical fish
  - Temperate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

http://www.oceanclimatechange.org.au

Climate change - disrupting natural systems first







IPCC 2007, WG II, Ch 11

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 hippopotamuses), reptiles and birds[1]. 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[2]. 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[5]. More dingoes could also help to control other feral animals, such as

A. BRAMWELL/ALAMY

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[9].

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.

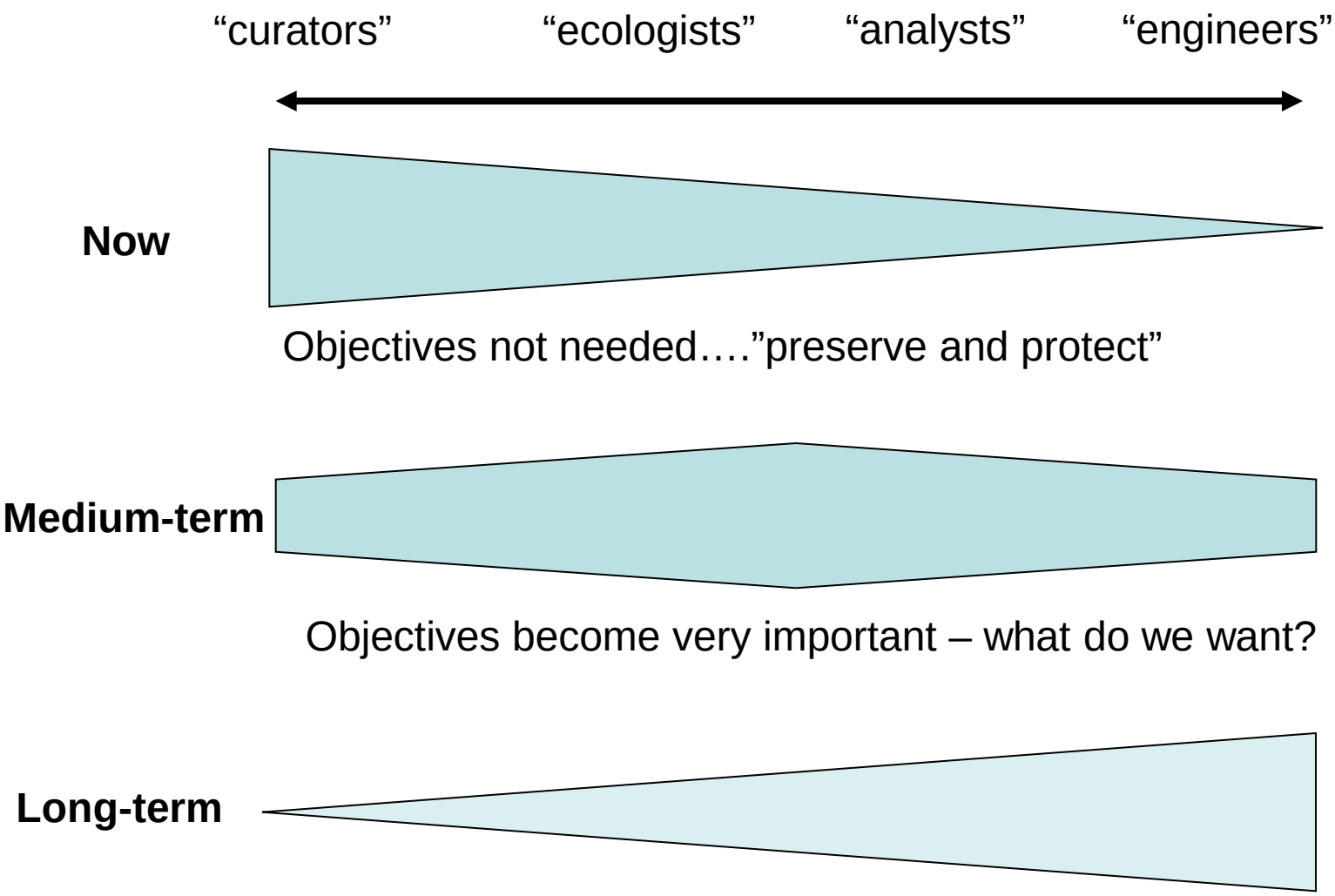
Of course, introducing large mammals cannot solve all of Australia’s ecological-management conundrums. And I am mindful that the proposal could be used to justify commercial grazing in fragile ecosystems, an ongoing controversy[10]. But the usual approaches to managing these issues aren’t working. The full spectrum of options needs to be canvassed in an open and honest way. ■

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

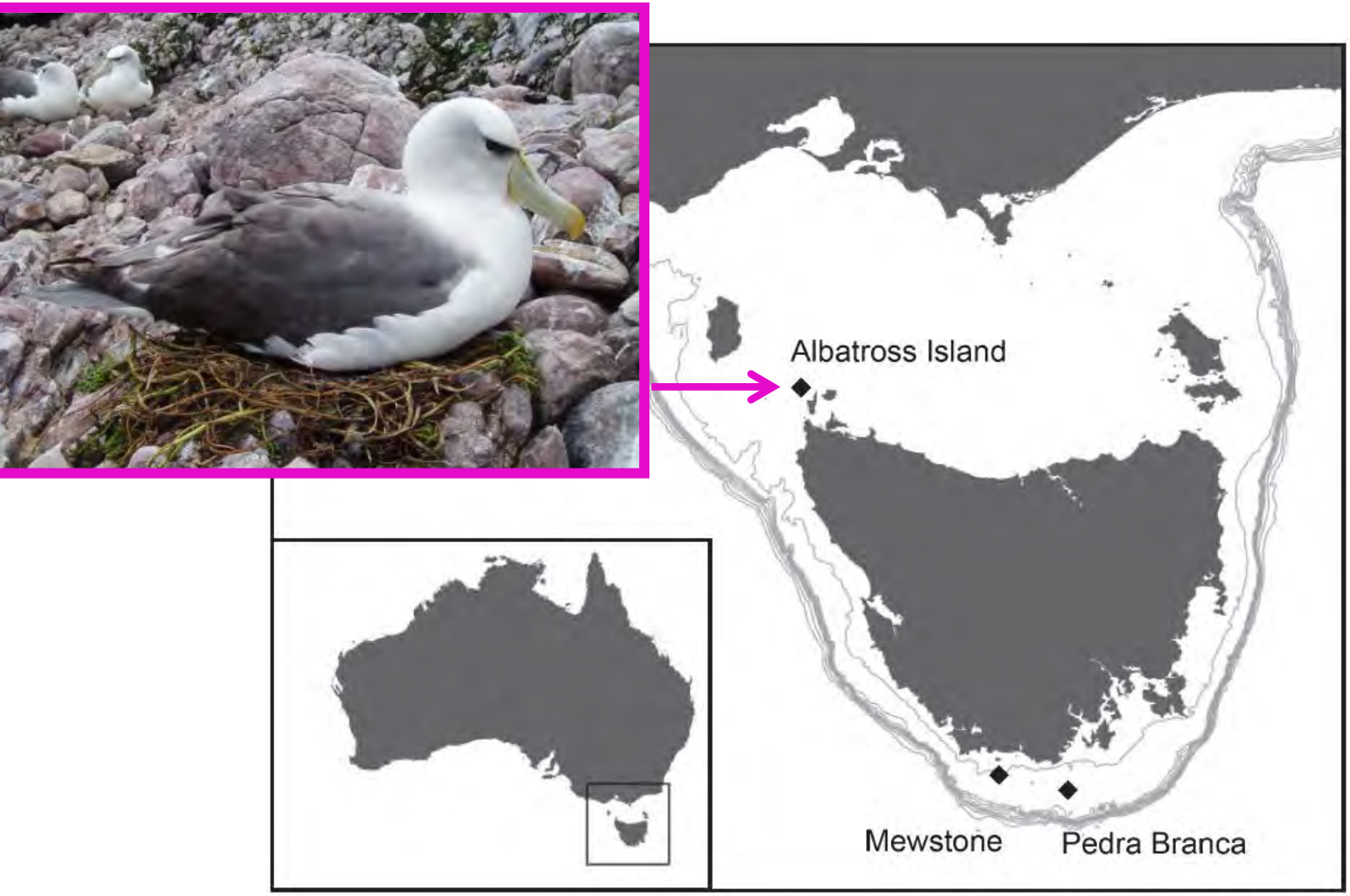
New management perspectives

- 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?

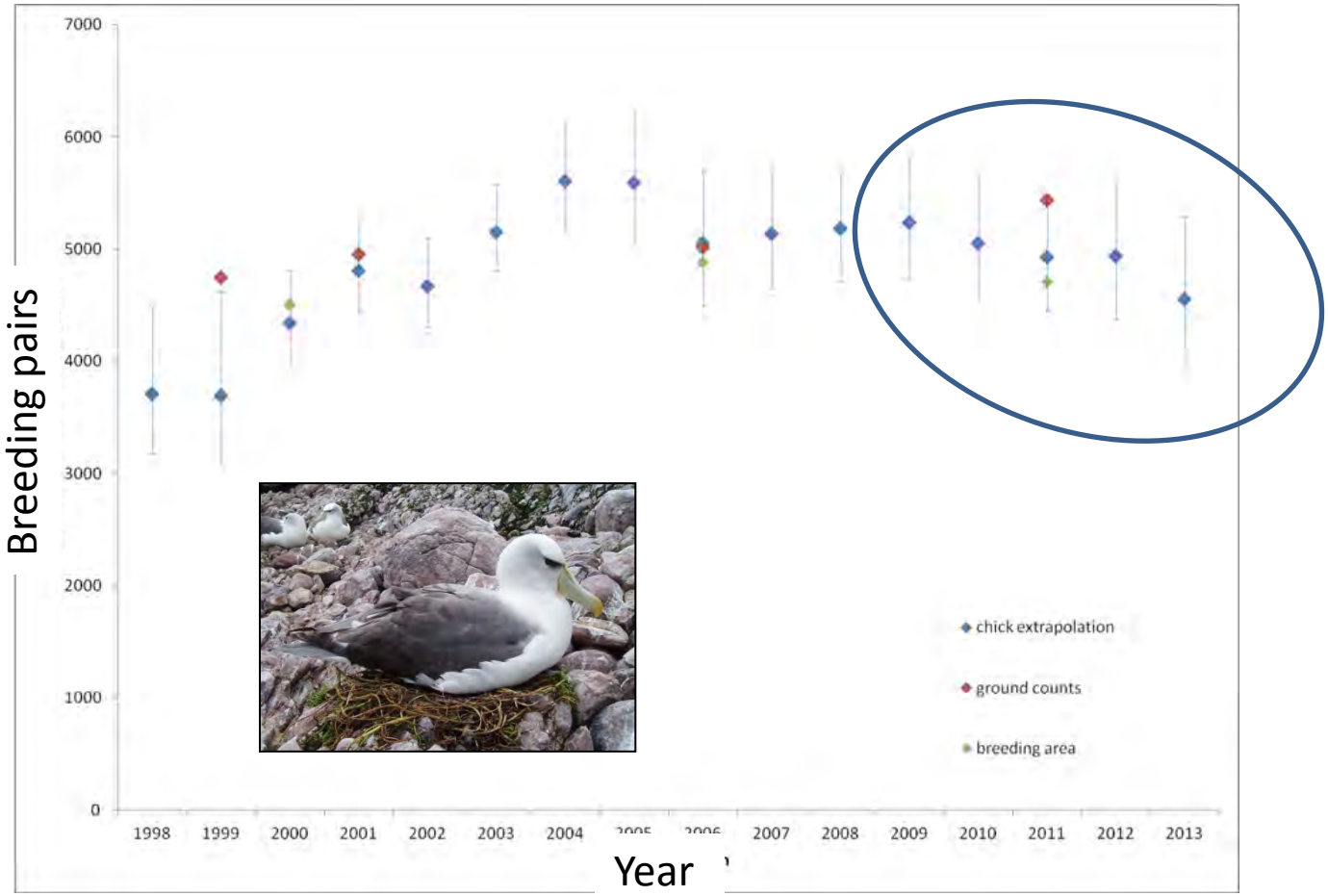


Shy albatross – endemic to Australia



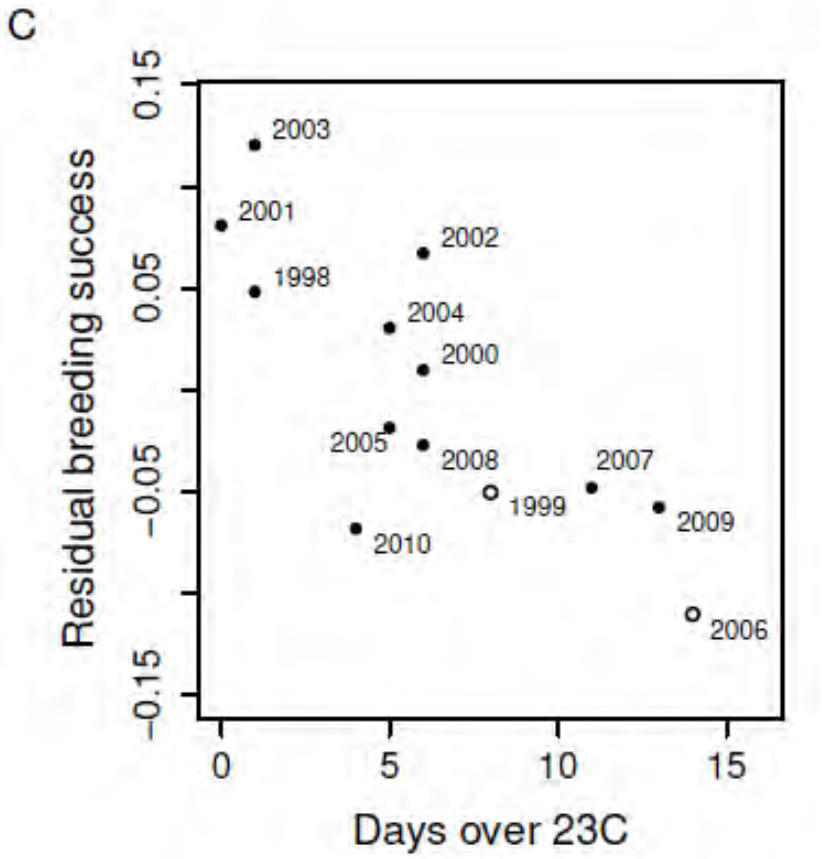
Albatross Island

- Population size appears to be declining….



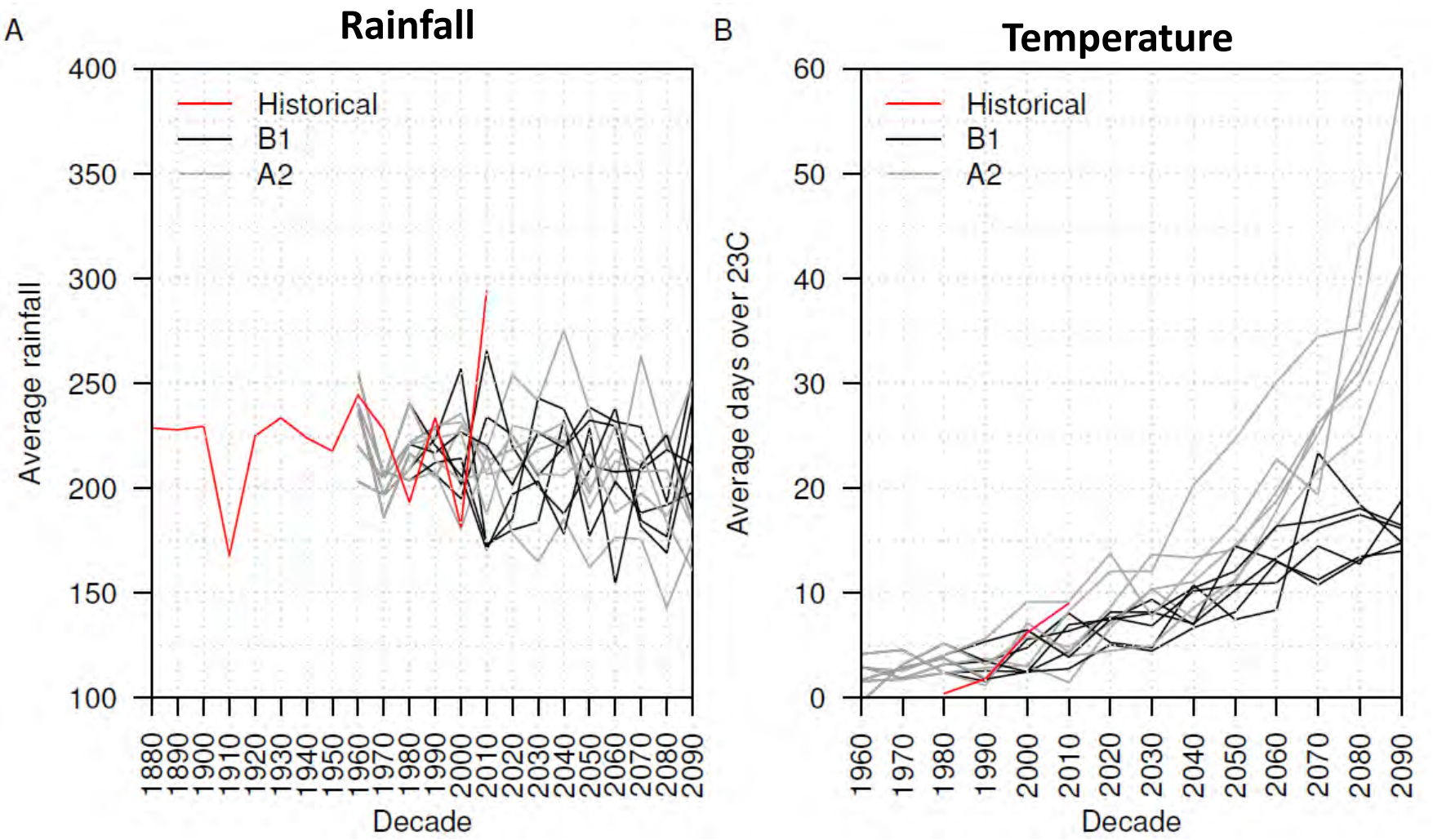
Clear climate signal

- Breeding success declines with temperature

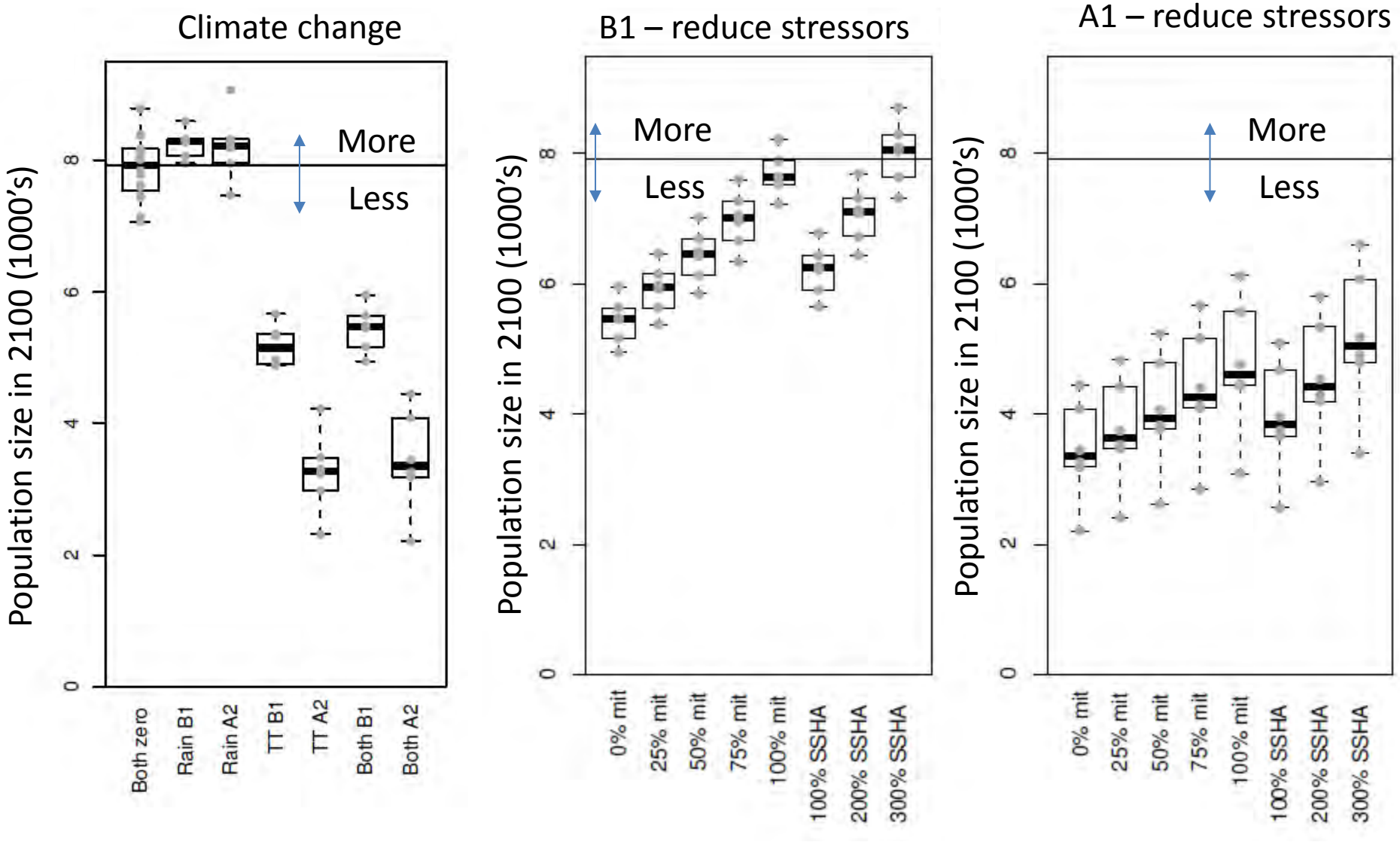


Thompson et al, in review

Future environment will be warmer



The future for Shy Albatross - fewer



Managers need adaptation options

Generate and evaluate adaptation options
Rapid assessment (SAPS tools)

Implementation of successful adaptation requires options that are	**"Responsible" group**	**Tools to assess options**
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

Hobday et al. 2014

Generate adaptation options

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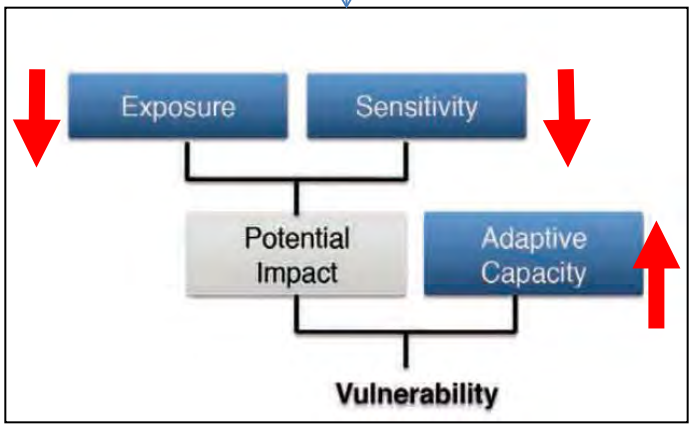

Reduce exposure
(avoid climate)
- Translocation
- Habitat modification
- Shading
- Engineering

Reduce sensitivity
(improve condition)
- Supplemental feeding
- Habitat modification
- Disease treatment

Increase adaptive capacity
(reduce other stressors)
- Reduce bycatch
- Pest eradication
- Predator management

Hobday et al 2014

Cost-benefit-risk tool
24 options

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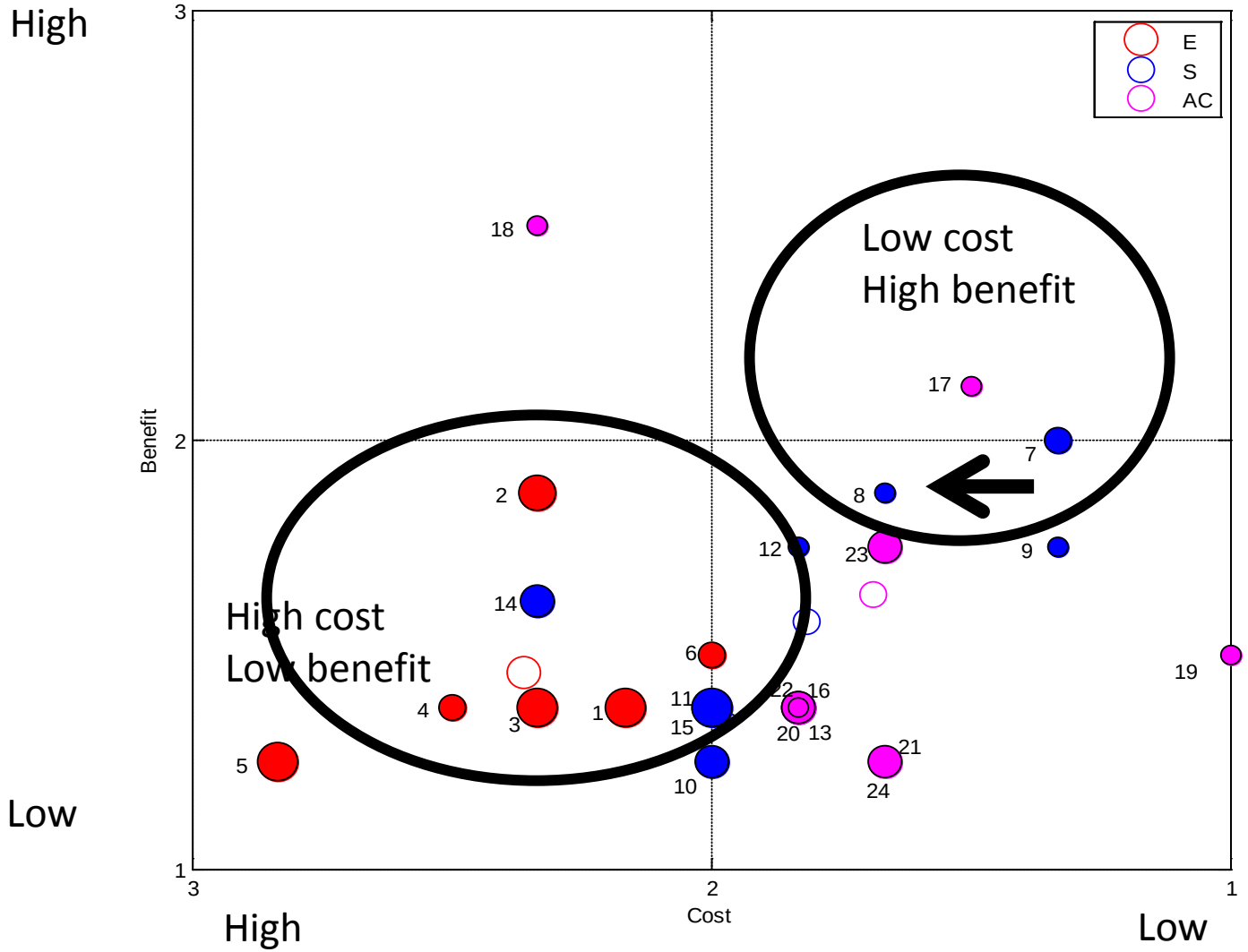


Selected an adaptation strategy

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

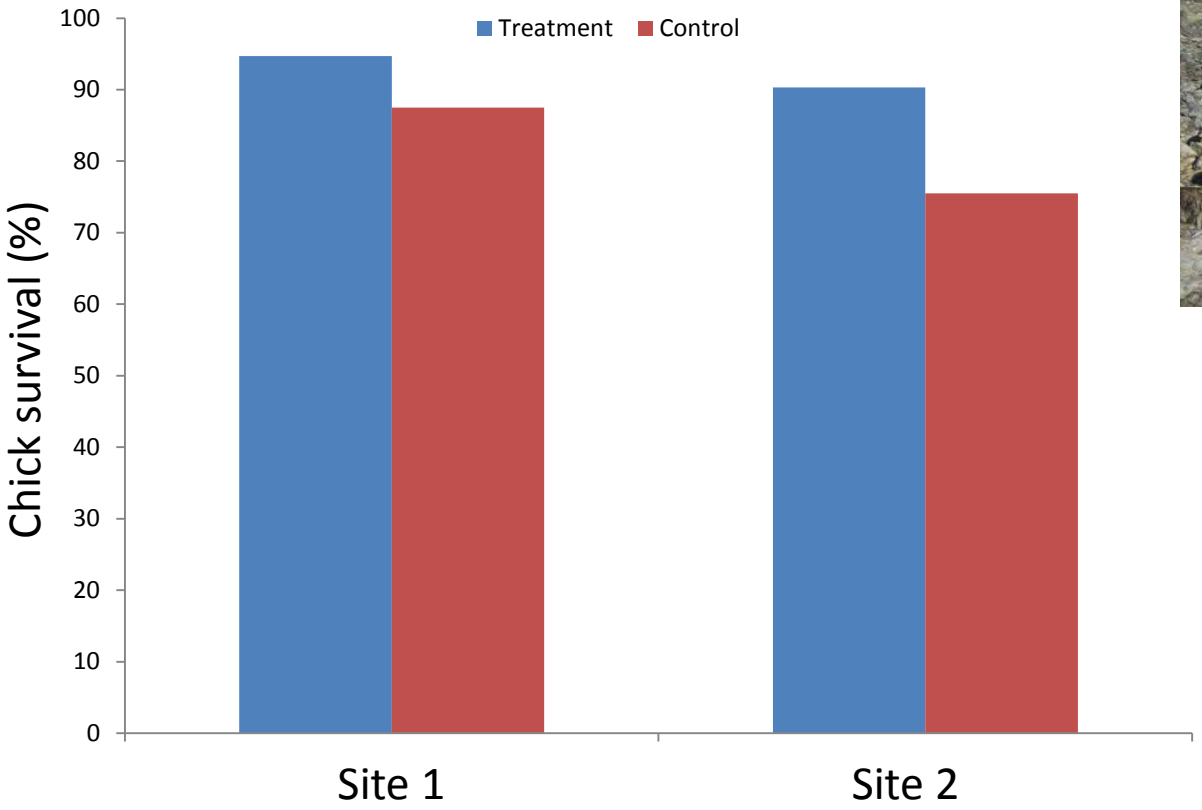
Enhance chick survival via disease reduction

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

February 2014

Chick survival 10% higher with intervention

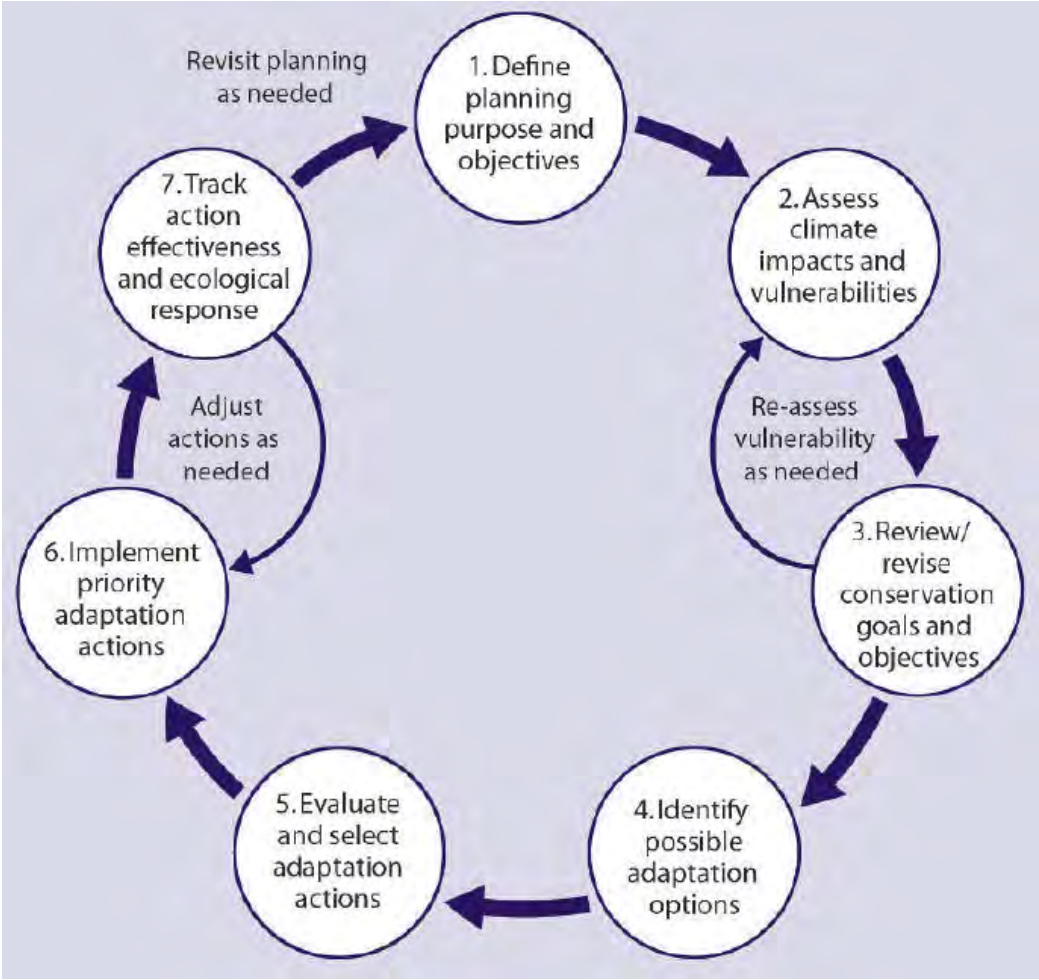
(after 6 weeks)



Alderman and Hobday (in review)

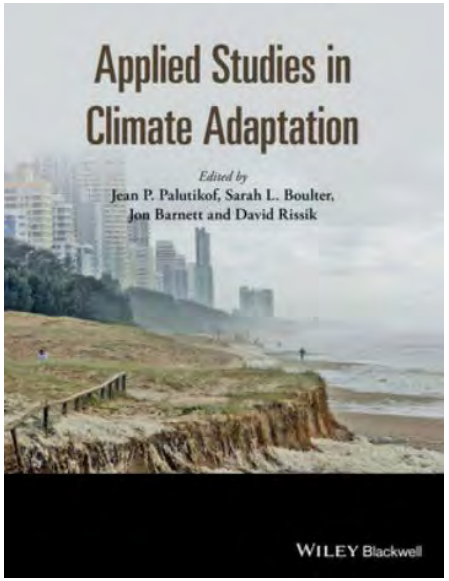
Adaptation "process" established

- 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



Stein et al 2013

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

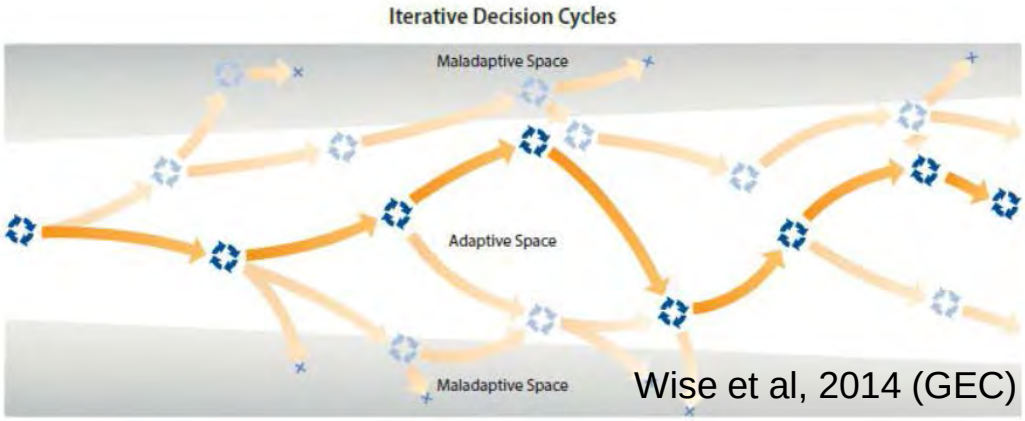
John Gould paintings from the Australian Museum

Australian museum

Lessons learned

Putting conservation adaptation into action

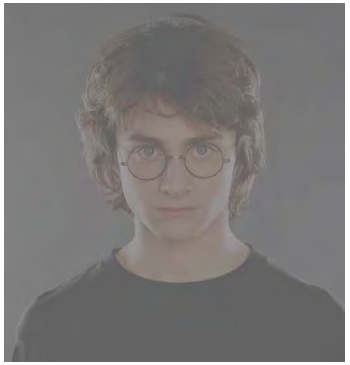
- Develop a range of options, in partnership
- Prioritize these options (e.g. SAPS)
- Initiate demonstration *in situ* projects
- Develop an adaptation pathway for long term planning



Wise et al, 2014 (GEC)

Career progression

Impacts	Attribution	Adaptation
"see"	"why"	"what to do"



Science → Management/Policy

<40 yrs.

40-60 yrs

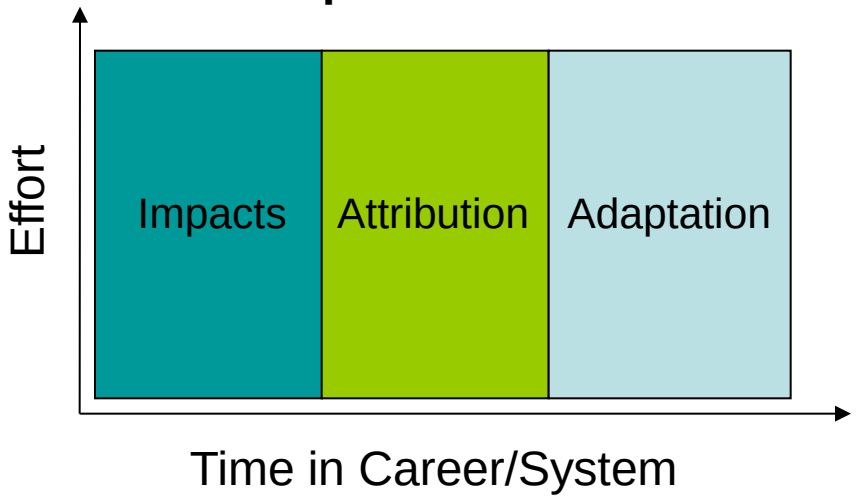
50-65 yrs.

Few years left….

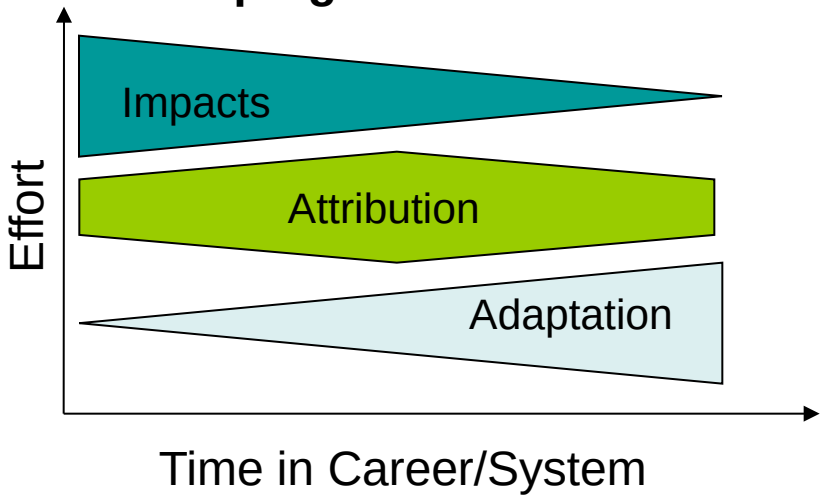
How can we speed this up?

What kind of scientist will be useful under climate change?

Scientist 1 (option A)
"optimist"

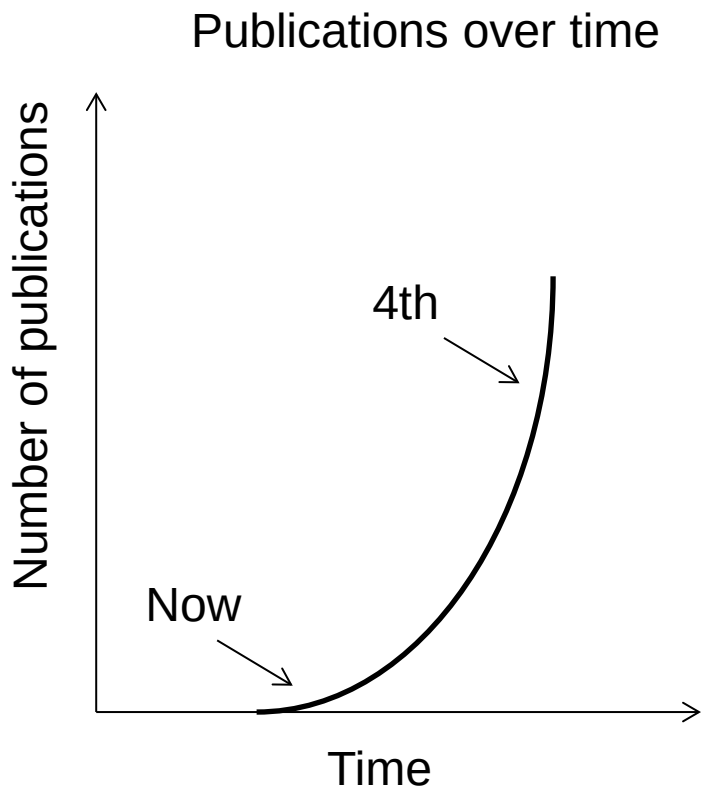


Scientist 2 (option B)
"pragmatist"



Hobday and Alderman, in review

And put some effort into it!



H_o = Recruitment to science (grad students)

H_1 = Recruitment to this topic (stampede)

Monitoring is important - learning

Methods in Ecology and Evolution

British Ecological Society

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[1]*, Rachael Alderman[2] and Alistair J. Hobday[1]

Lynch et al 2015 - Table of image URLs

e.g. 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