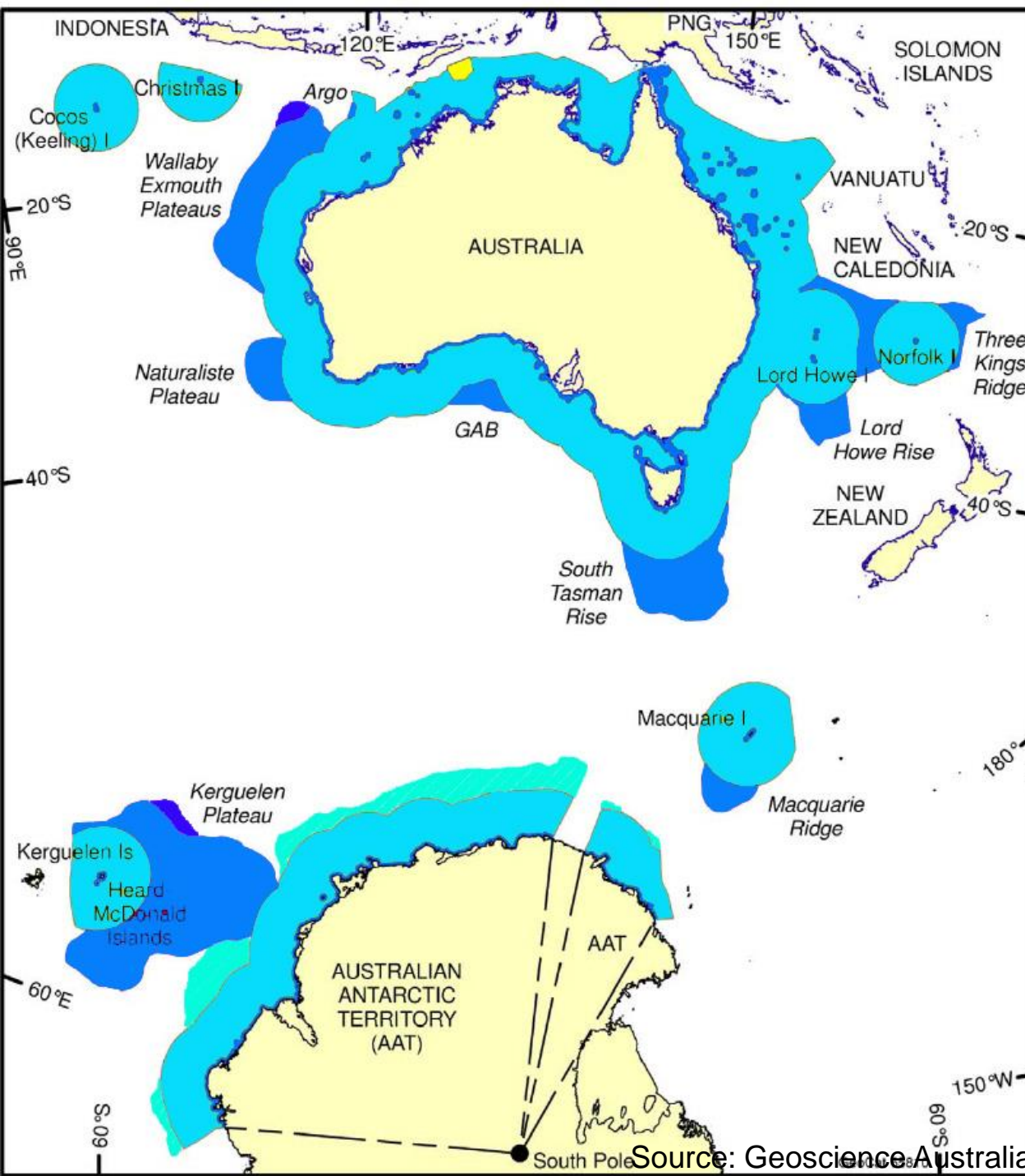


# Blue Australia: fringe dwellers, fragmented management and increasing pressures



**Professor Peter Harrison**  
**Marine Ecology Research Centre**





# Australia is vast

7.69 million km<sup>2</sup> land  
(AAT 6 million km<sup>2</sup>)

EEZ+Sea ~9 million km<sup>2</sup>

AAT sea 2 million km<sup>2</sup>

Ext. CS 2.5 million km<sup>2</sup>

Marine = 13.8 million km<sup>2</sup>

Huge areas to manage

>35,000 km coast

Coastal fringe dwellers

# Australia 'megadiverse' ~7-10% species (SoE 2011)

Isolated 'island' continent

- unique biodiversity land and water
- very high endemism
- global biodiversity hot spots

We have national + global responsibility for management





# Australia 'megadiverse'

## Marine biodiversity (Vertebrate Conservation NMS, Butler et al. 2010)

>32,000 known species (est. 250,000 macroscopic spp.)

very high endemism southern temperate area  
~1570 macroalgae

~25,000 invertebrate

- >400 coral, >8500 mollusc, >6000 crustacean spp.
- major fish centre >5000 spp.
- global centre for sharks, rays 323 spp. (51% endemic)
- 6 (of 7) marine turtles
- 35 of world's 60+ sea snakes (31% endemic)
- 47 of 89 extant cetacean species (2 near endemic)





# Australia's biodiversity declining (historic + ongoing)

## *Environment Protection & Biodiversity Conservation Act 1999*

Powerful national environmental legislation



Photos Peter Harrison



# ***Environment Protection & Biodiversity Conservation Act 1999***

Protects environment and biodiversity, particularly MNES

- Nationally **threatened Species and ECs**
- **Migratory** species
- Commonwealth **marine** areas (Parks?)
- **GBR Marine Park**
- **Heritage** etc.



Similar State and Territory legislation

**Currently 1857 threatened (1791 spp., 66 ECs) 21 KTP**



Photos Peter Harrison



# *Environment Protection & Biodiversity Conservation Act 1999*

**Currently 1857 threatened (1791 species, 66 ECs)**

Problems: ↑ numbers threatened entities need active sustained management, funding, resources (increasingly limited)

Will need prioritisation

Lack monitoring most threatened species, Rec Plan 5 yr?



# *Environment Protection & Biodiversity Conservation Act 1999*

Problems: List needs review, many 'grandfathered' in, limited capacity, stringent process = slow progress

Need national threatened species monitoring (complex)  
Frustration ... solution

Mammal Action Plan (Woinarksi, Burbidge, Harrison 2014)

Bird Action Plan (Garnett et al. 2011)

Similar trends: ongoing decline in conservation status, increased extinction risk, some threatened species not listed, wrong category, some delisting

Revising list big task, TSSC + Dept new species expert assessments other taxa - reassess conservation status

EPBC IUCN



# *Environment Protection & Biodiversity Conservation Act 1999*

## **Data Deficient Problem**

Too little information on most species (taxonomy)  
population size, trends, distribution, threats

Precludes assessment of status, management actions  
e.g. 74% of 47 cetacean species DD (decades)

Terrestrial environmental changes often more readily  
seen, marine environments changes harder to detect



Photo Peter Harrison



# **Environment Protection & Biodiversity Conservation Act 1999**

**Emerging problem: Deregulation Agenda 'One-stop shop' State/Territory accredited environmental approvals**

Simplified assessments and approvals process risky

Unclear extent of Commonwealth oversight, review of State based decisions on development approvals

**Significant potential threat to environment management\***

Needs very careful planning and review to avoid erosion of EPBC Act, perverse or catastrophic outcomes ...

Solution = don't (or guaranteed)



Humpback whales – back from the brink of extinction

Outstanding conservation success

East coast 22-26,000, whaling 100s, now ~20,000 +10%

West coast recovery



VU no longer meet criteria LC (Cons Dependent better)

Celebrate success

Photo Peter Harrison



>12,000 km migrations

Kimberley  
D

GBR breeding  
E1



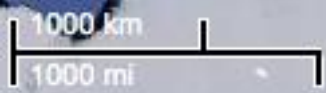
Whaling previous key threat

Japan 'Special Permit' whaling (ICJ)

Southern Ocean summer feeding

Southern Ocean Sanctuary

Australian Whale Sanctuary





**Whaling 'lessons'** >2 million whales killed SH

Severe declines – 362,000 Blue whales (EN, CR)



725,000 Fin (VU EN)

203,000 Sei (VU EN)

213,000 Humpbacks

Need independent management, monitoring, illegal take

**Similar global fisheries problems emerging**

Photo Peter Harrison



# Antarctica



Climate change

Photo Peter Harrison



# Climate change temperature - sea ice – krill fuel migrations seawater pH ‘ocean acidification’



Pollution risks (fuels)

Fisheries krill (ecosystem)

International management

Photo Peter Harrison



Migrate north into coastal waters



increasing threats noise,  
vessel strike, bycatch, pollution,  
coastal development etc.

Photo Peter Harrison



# Giant Kelp Forests SE Australia EC (EN decline)

Interacting threats climate + ocean change EAC, urchins, fisheries, pollution

Tasmanian endemic threatened handfish

- Spotted (CR) <1500
- Red (CR) rare, 1 site
- Ziebell's (VU) local losses, unknown

Threats scallop dredging, loss spawning substrata, pollution, invasive seastar etc.

Foundation species *Macrocystis pyrifera*

Photo Peter Harrison



# Great Barrier Reef breeding grounds (?)

GBR >3,000 reefs 2,300 km

World Heritage biodiversity icon >\$6 billion

Naturally resilient, increasingly threatened



Photos Peter Harrison



# GBRMP coast industrial development, ports threats

Cumulative impacts

Dredge spoil

Coal dust

Shipping

Run-off

Land clearing

Climate change

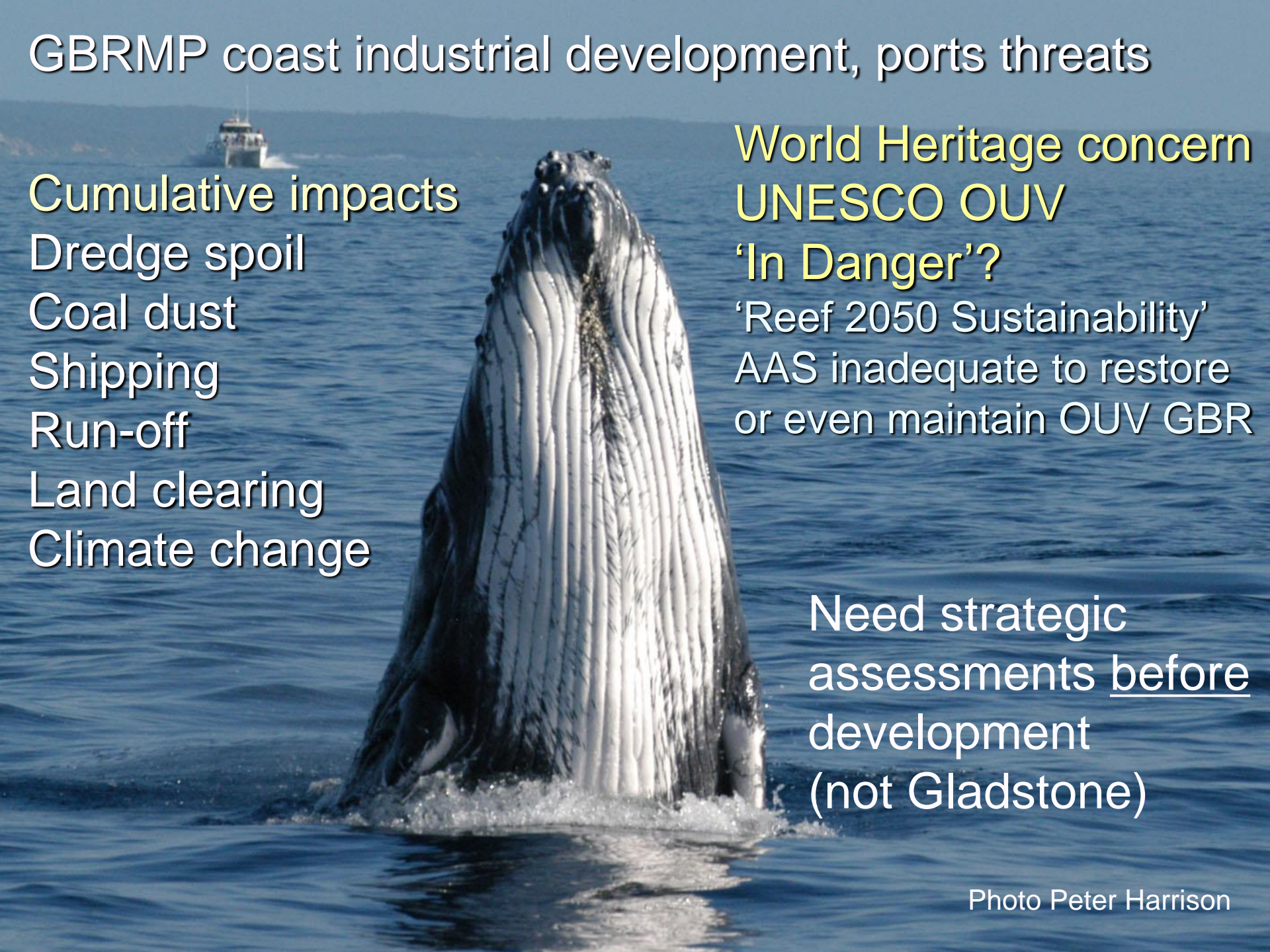
World Heritage concern  
UNESCO OUV

'In Danger'?

'Reef 2050 Sustainability'  
AAS inadequate to restore  
or even maintain OUV GBR

Need strategic  
assessments before  
development  
(not Gladstone)

Photo Peter Harrison





# Coastal GBR impacts increasing

Dugong urban coastal Qld (CR) (Marsh et al. 2011)

Snubfin dolphin (NT) Fitzroy R subpop. <100 (EN)

Port Alma expansion threat 25% core habitat, pollutants  
(Cagnazzi et al. 2013)





Reef threats: climate change bleaching, pH calcification, cyclones, crown of thorns, pollution run-off, overfishing

1.5-2° C Loss of *Symbiodinium* dinoflagellates



Climate change models predict increased bleaching, cyclones, extreme events

Photos Peter Harrison



# GBR multiple stressors (De'ath et al. 2012)

AIMS long-term monitoring 214 reefs, 27 years

**major coral cover loss 50.7%** (1985 to 2009)

cyclones (48%) COTS (42%) bleaching (10%)

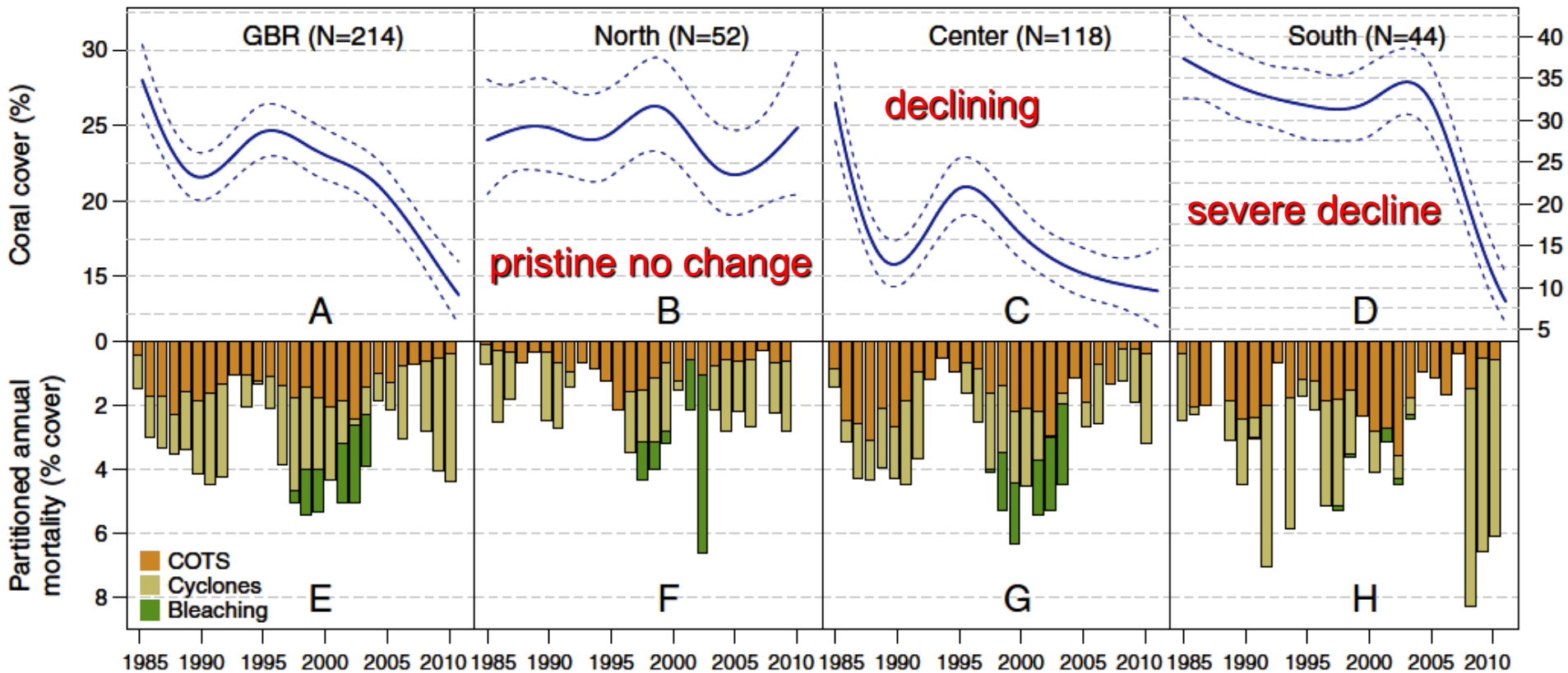


Fig. 2. Temporal trends in coral cover (A–D) and annual mortality due to COTS, cyclones, and bleaching (E–H) for the whole GBR and the northern, central, and southern regions over the period 1985–2012 (N, number of reefs). (A–D) Trends in coral cover, with blue lines indicating estimated means ( $\pm 2$  SEs) of each trend. (E–H) Composite bars indicate the estimated mean coral mortality for each year, and the sub-bars indicate the relative mortality due to COTS, cyclones, and bleaching. The periods of decline of coral cover in A–D reflect the high losses shown in E–H.



Corals are foundation species  
Manage locally for **resilience**



**Successful reproduction essential (sensitive)**  
**Manage for recruitment not only adult communities**

Photo Peter Harrison



Blue 'highway' multiple threats - Antarctica to GBR  
marine systems resilient but increasing pressures,  
climate - ocean changes evident (cumulative impacts)



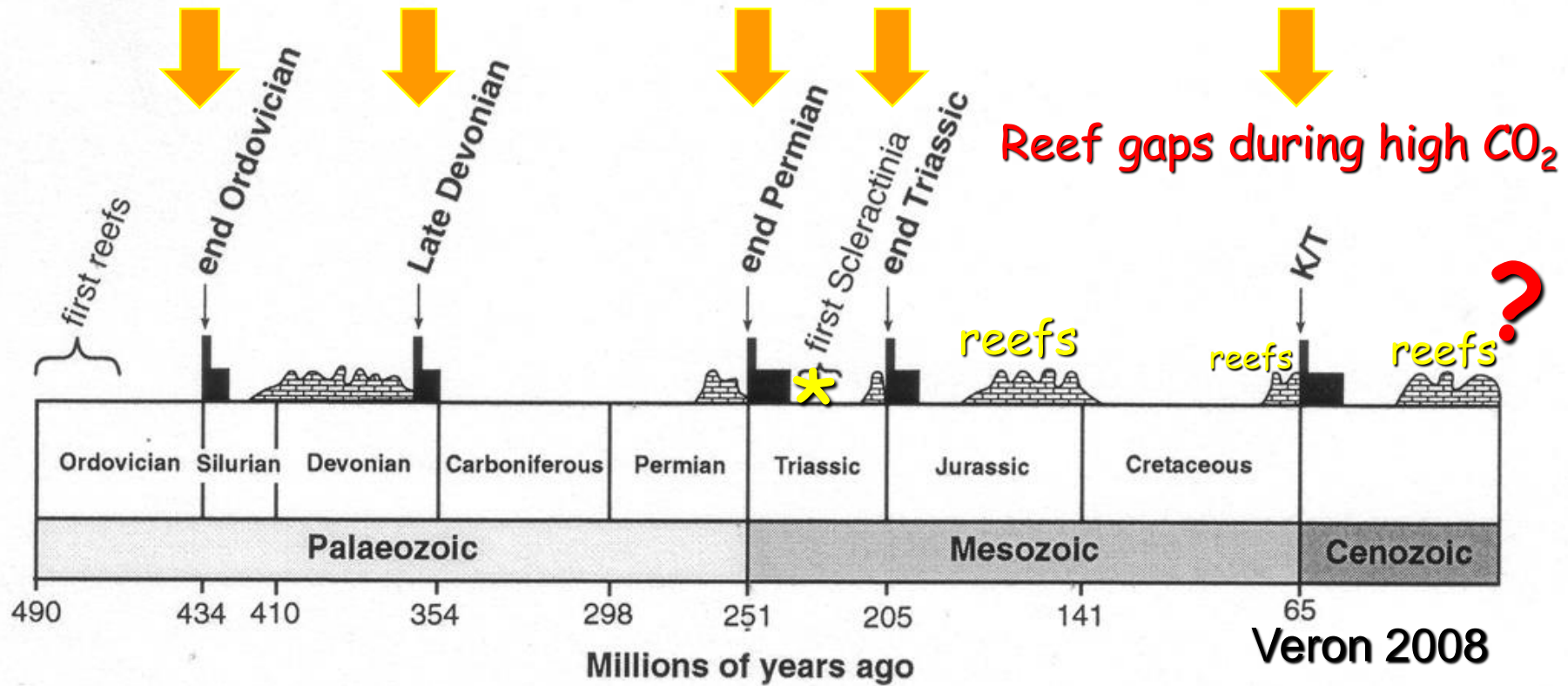
EPBC Act and State/Territory Acts critical, need better  
coordination to strengthen not erode their powers

Photo Peter Harrison



# Mass Extinctions and 'Ocean acidification'

5 Mass extinction events + Global reef loss >4 my



Multiple causes - strong links to C cycle - CO<sub>2</sub>  
6th mass marine extinction?



Thanks for Listening



Photo Peter Harrison