Current and Emerging Threats to Coastal and Marine Biodiversity Conservation…

…experiences from Australia's Great Barrier Reef

Presentation at Wildlife Institute of India, Dehradun

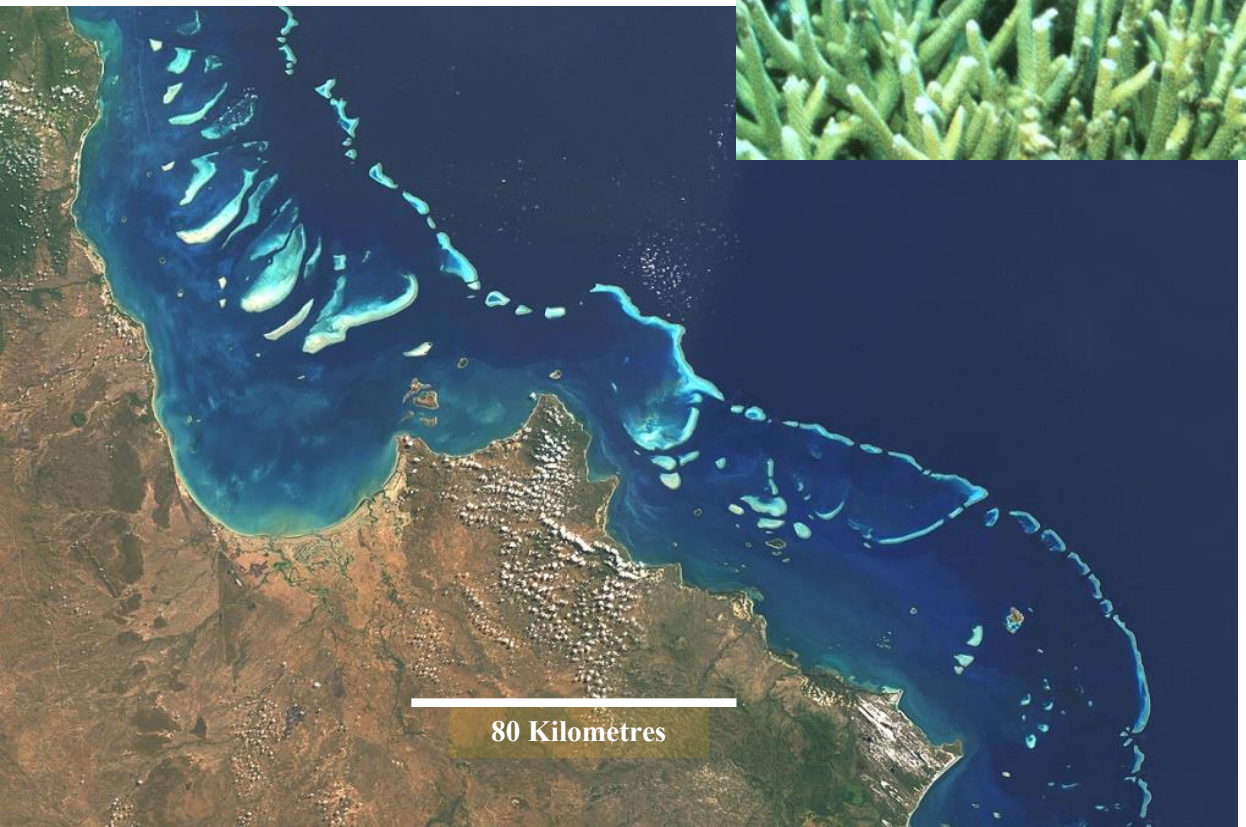
3rd March 2017

Jon C. Day

ARC Centre for Coral Reef Studies, James Cook University, Australia

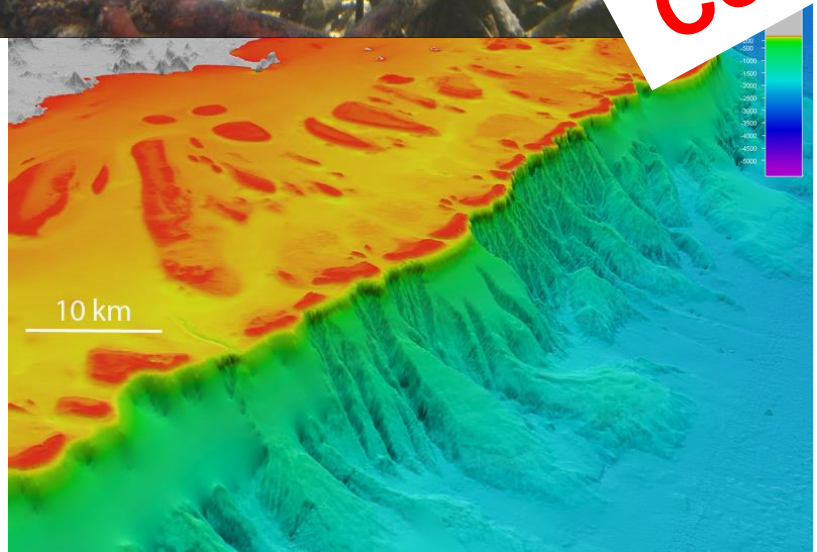
- GBRWHA = 348,000 sq km
- ~ 2,300 km long
- Marine Park = 99% of the WHA

Significant marine habitats



Coral reefs ~ 10% of GBR Marine Park

Significant marine habitats

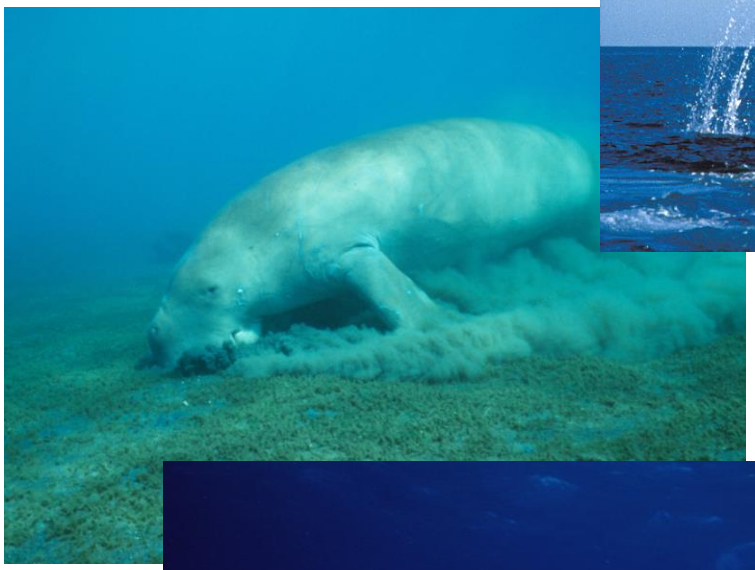


Connectivity

As well as coral reefs:

- **mangroves**
- **seagrass beds *(shallow & deepwater)***
- **sandy and muddy bottom communities**
- **continental slope *(15%)***
- **deep oceanic waters *(16%)***

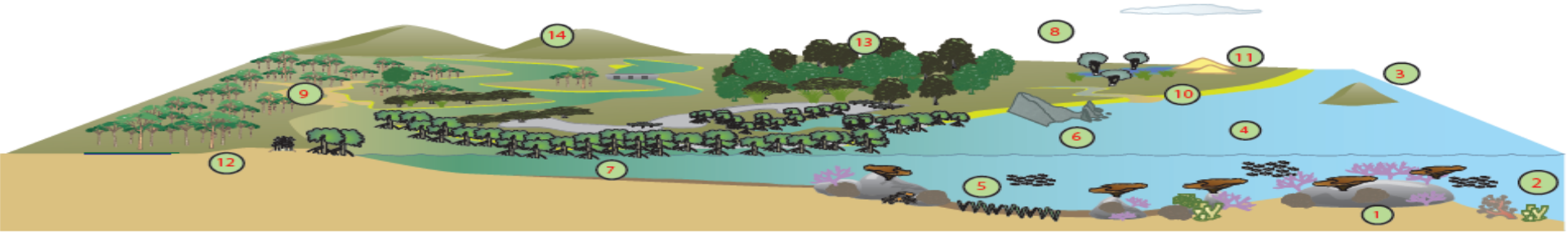
Iconic Species

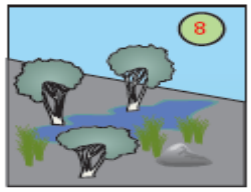


Important islands

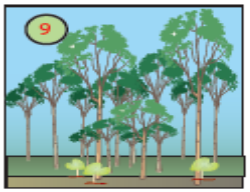
(continental/high islands, sand cays, mangroves)

…. and inter-tidal areas

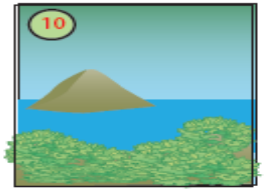




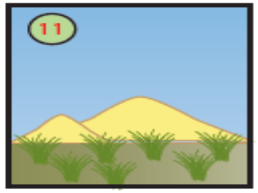
FRESWATER WETLANDS



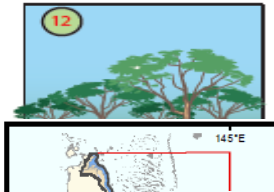
FOREST FLOODPLAIN

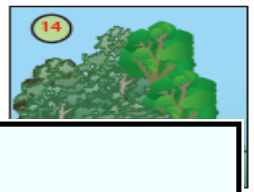


HEATH & SHRUBLANDS



GRASSLANDS

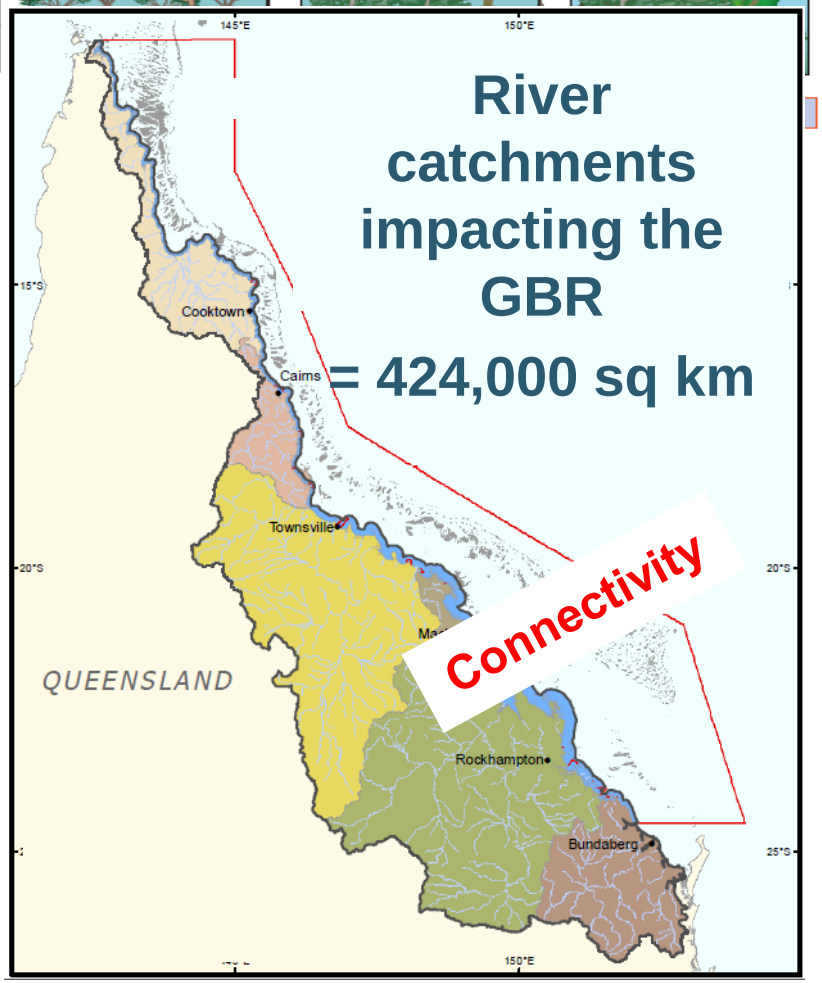




Significant coastal habitats

River catchments impacting the GBR

= 424,000 sq km



GBR is worth ~AUD $6 billion per annum

Changing management challenges for the GBR over last 50 years

1970s
- limestone mining
- oil drilling

1980s
- crown of thorns
- increasing tourism

1990s
- fishing (trawling)
- threats to biodiversity

2000s
- water quality issues
- coastal development
- fishing (netting)

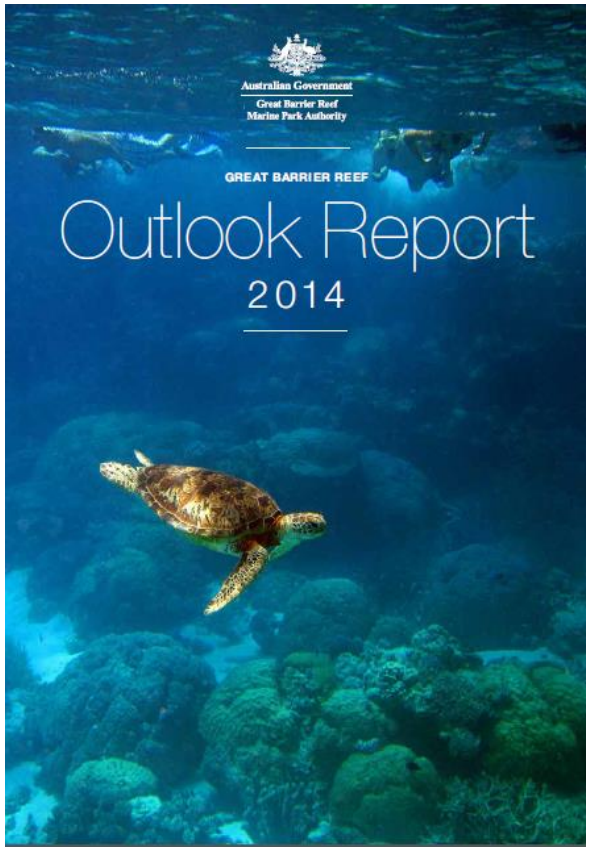
current

Numerous challenges

.....

GBR Marine Park Act - 1975

GBR Outlook Report 2014



"Climate change, poor water quality from land-based run-off, impacts from coastal developments and some remaining impacts of fishing remain the four major threats to the future vitality of the Great Barrier Reef"

(Executive summary, p. v)

Risk matrix for 41 risks in GBR

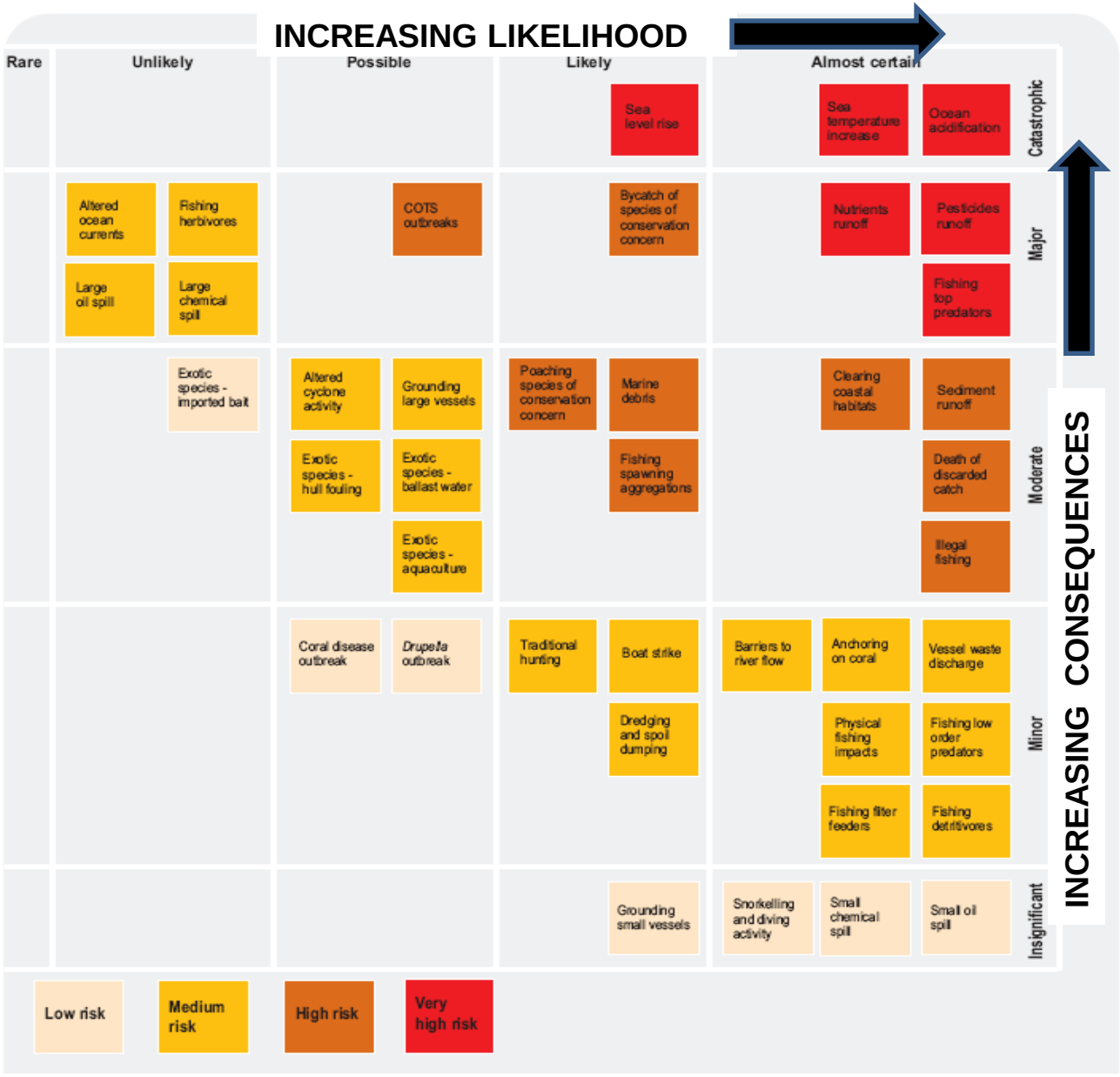
(from Outlook Report, 2009)

Likelihood

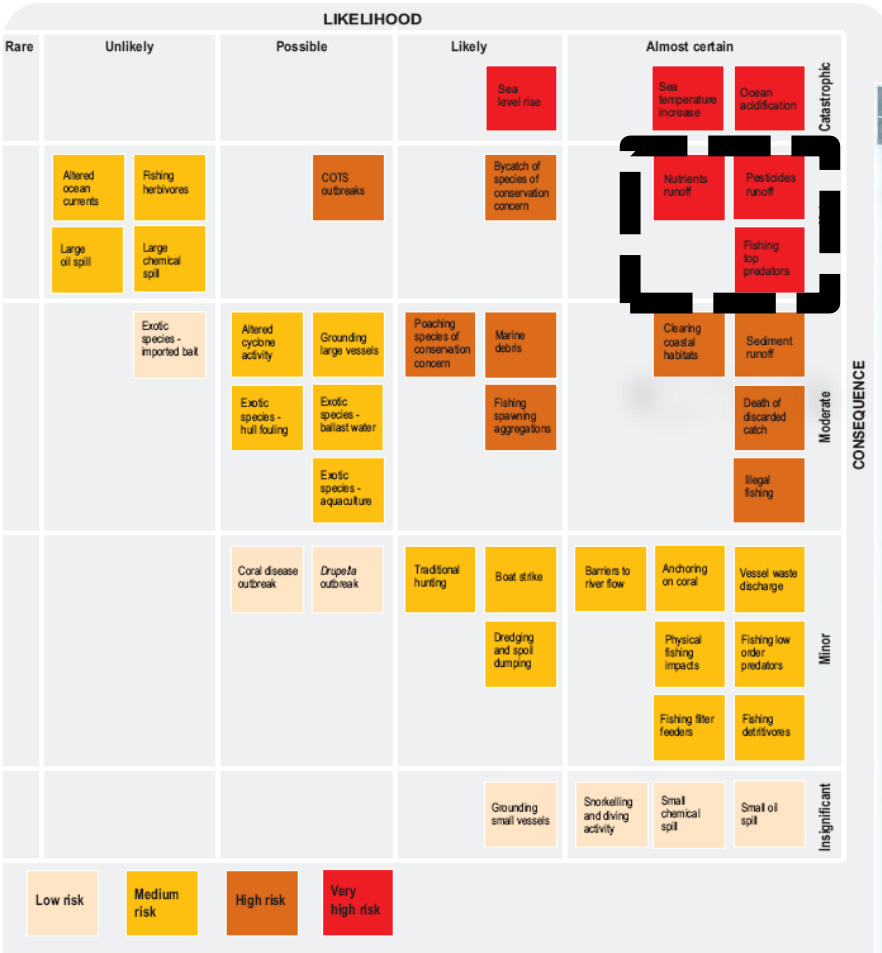
(Rare ….. Almost Certain)

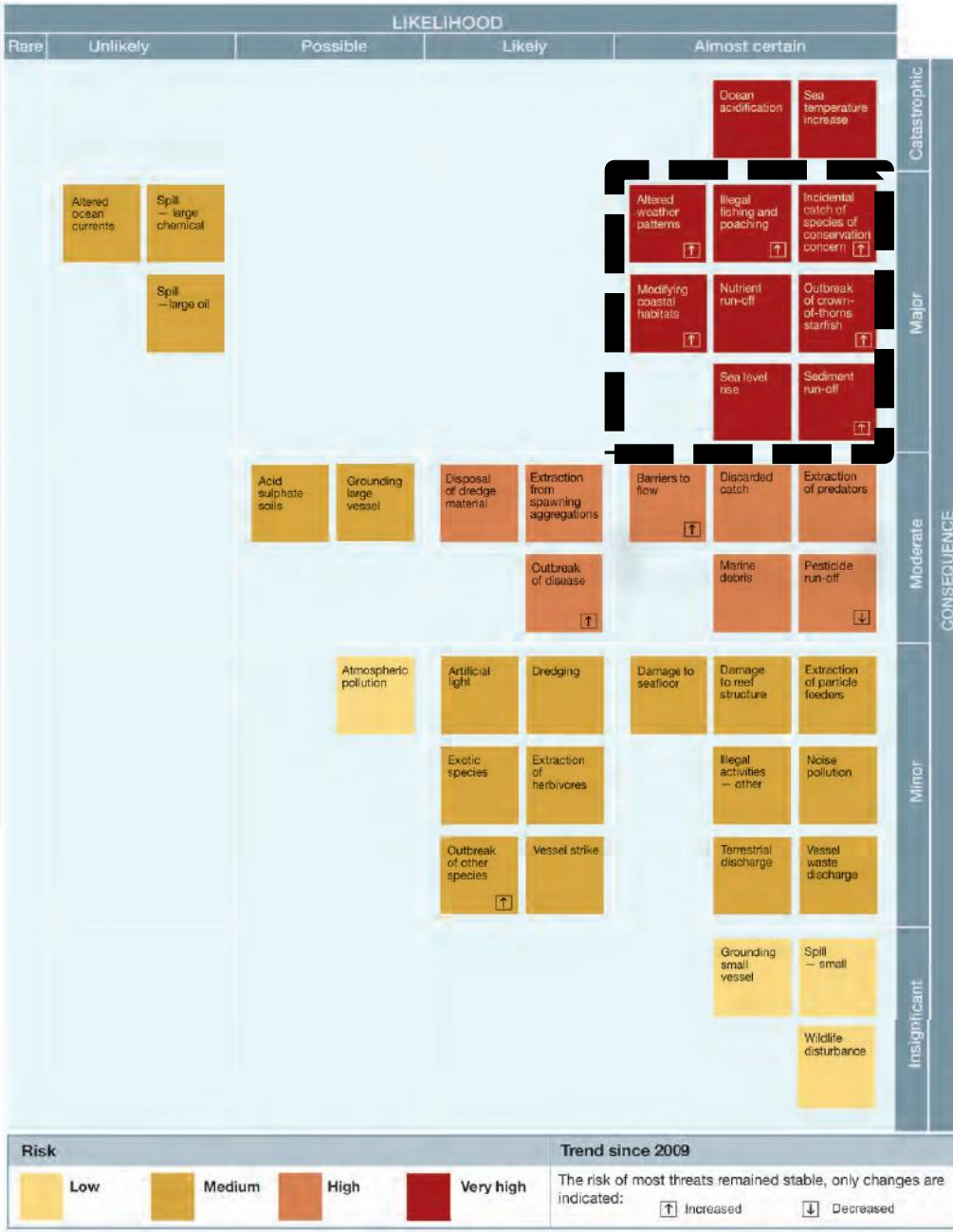
Consequence

(Insignificant ….. Catastrophic)



Risk matrices





Outlook Report 2009

Almost certain, Major consequence - 3 High risks

Outlook Report 2014

Almost certain, Major consequence - 8 High risks


Climate
change


Water
quality

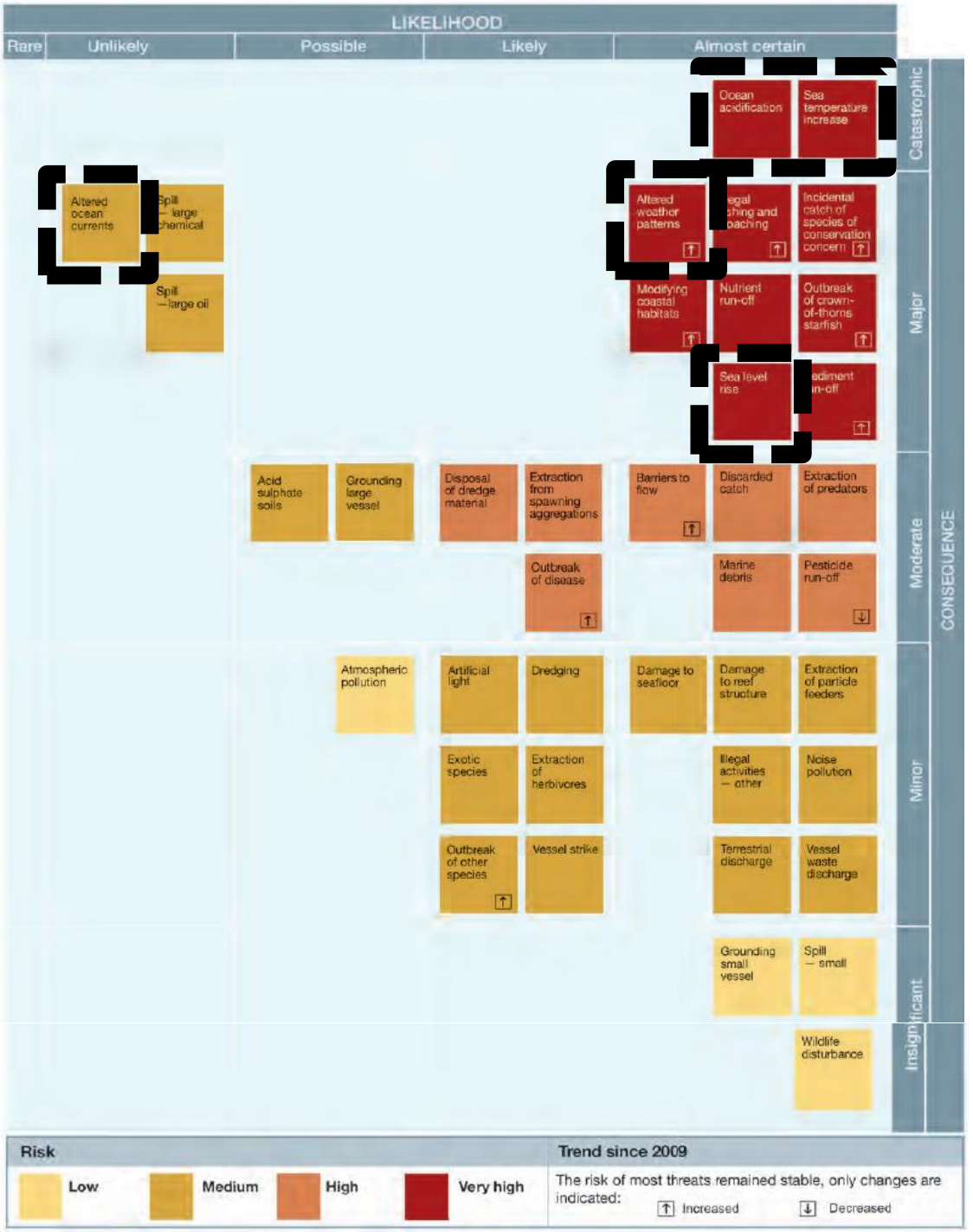

Coastal
development

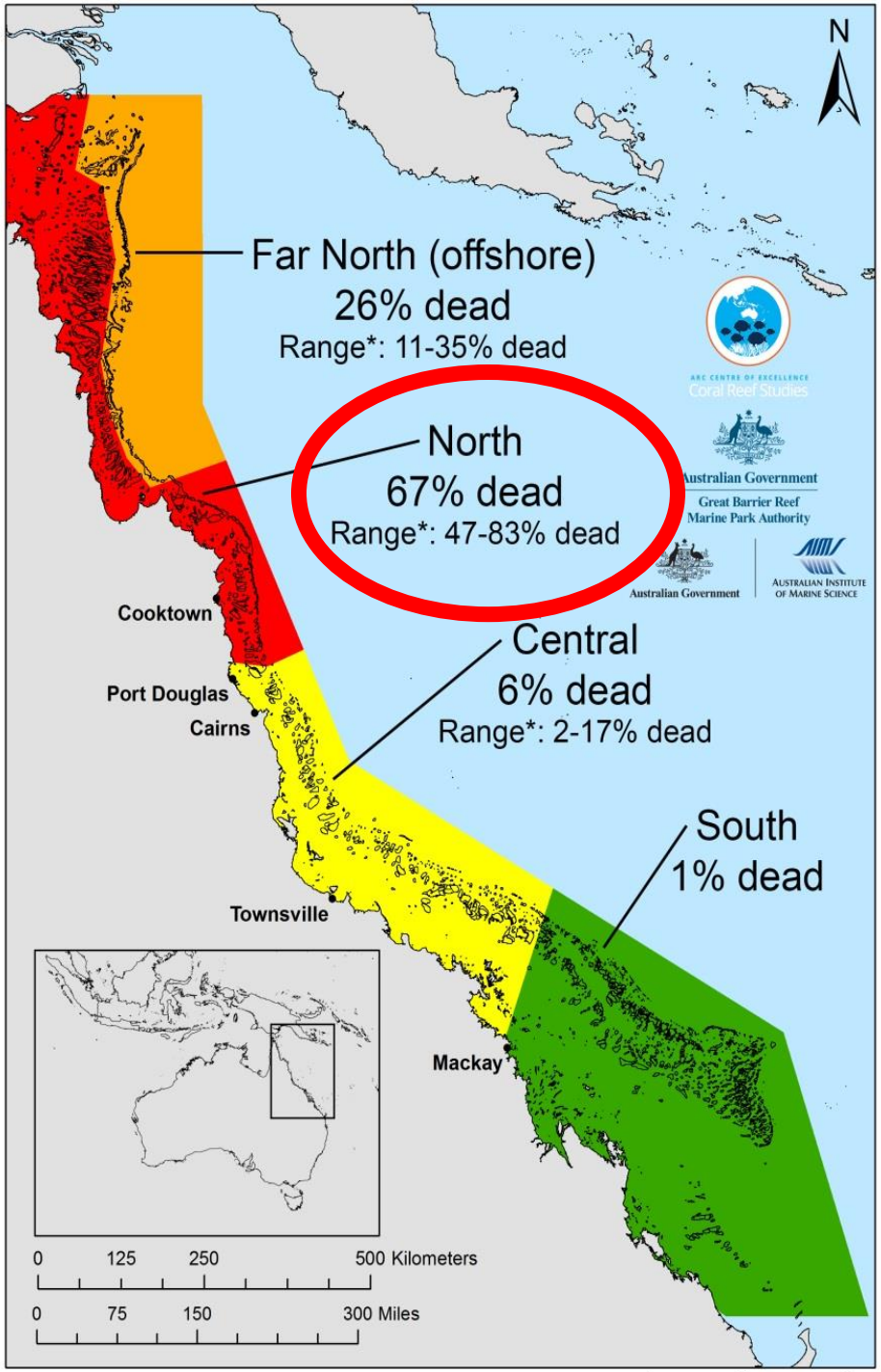

Unsustainable
fishing
impacts

Climate change

~ 5 risks

- **Ocean acidification**
- **Sea temp increase**
- **Sea level rise**
- **Altered weather patterns**
- **Altered ocean currents**





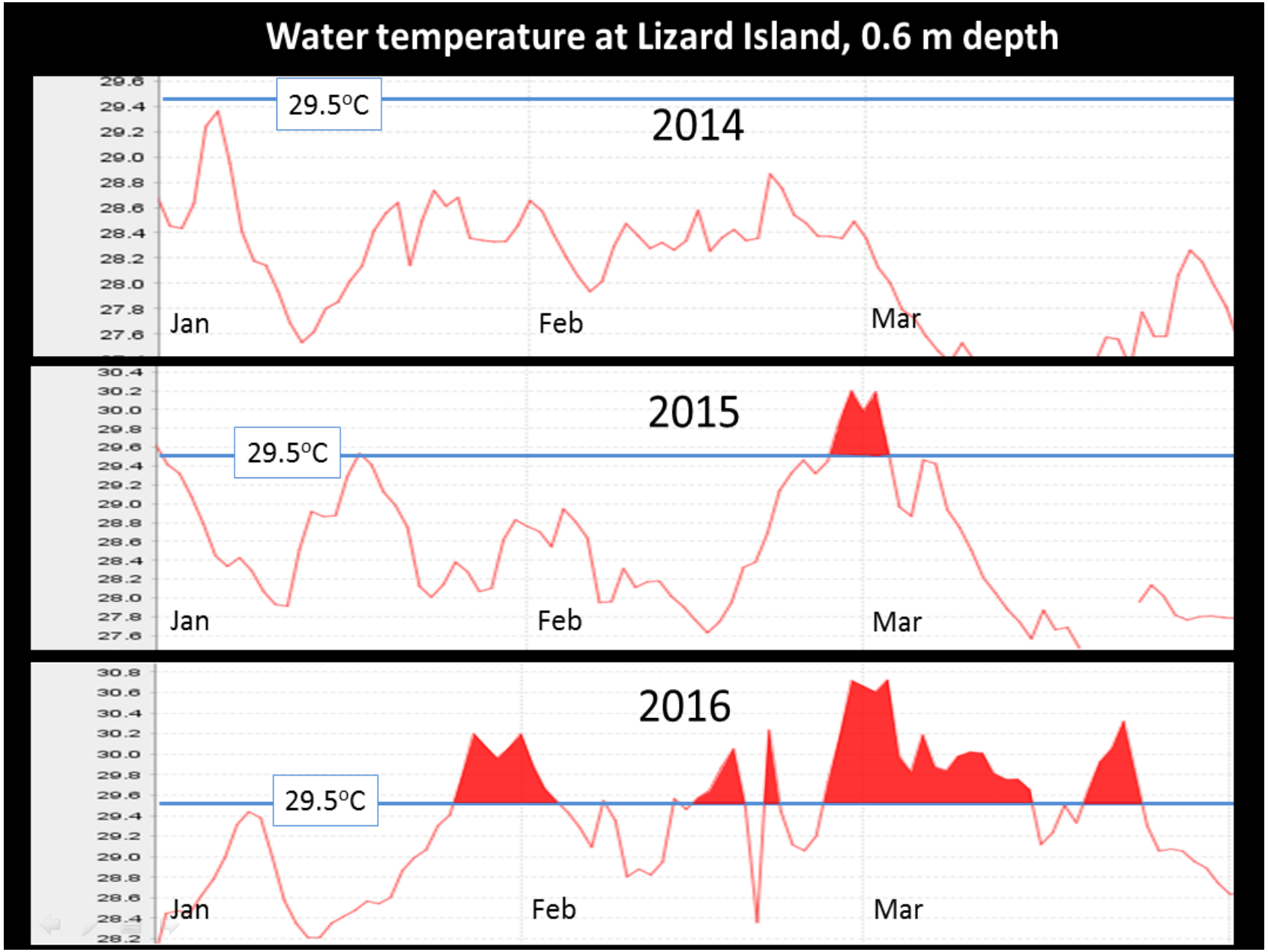
Coral mortality across GBR after the 2016 bleaching event

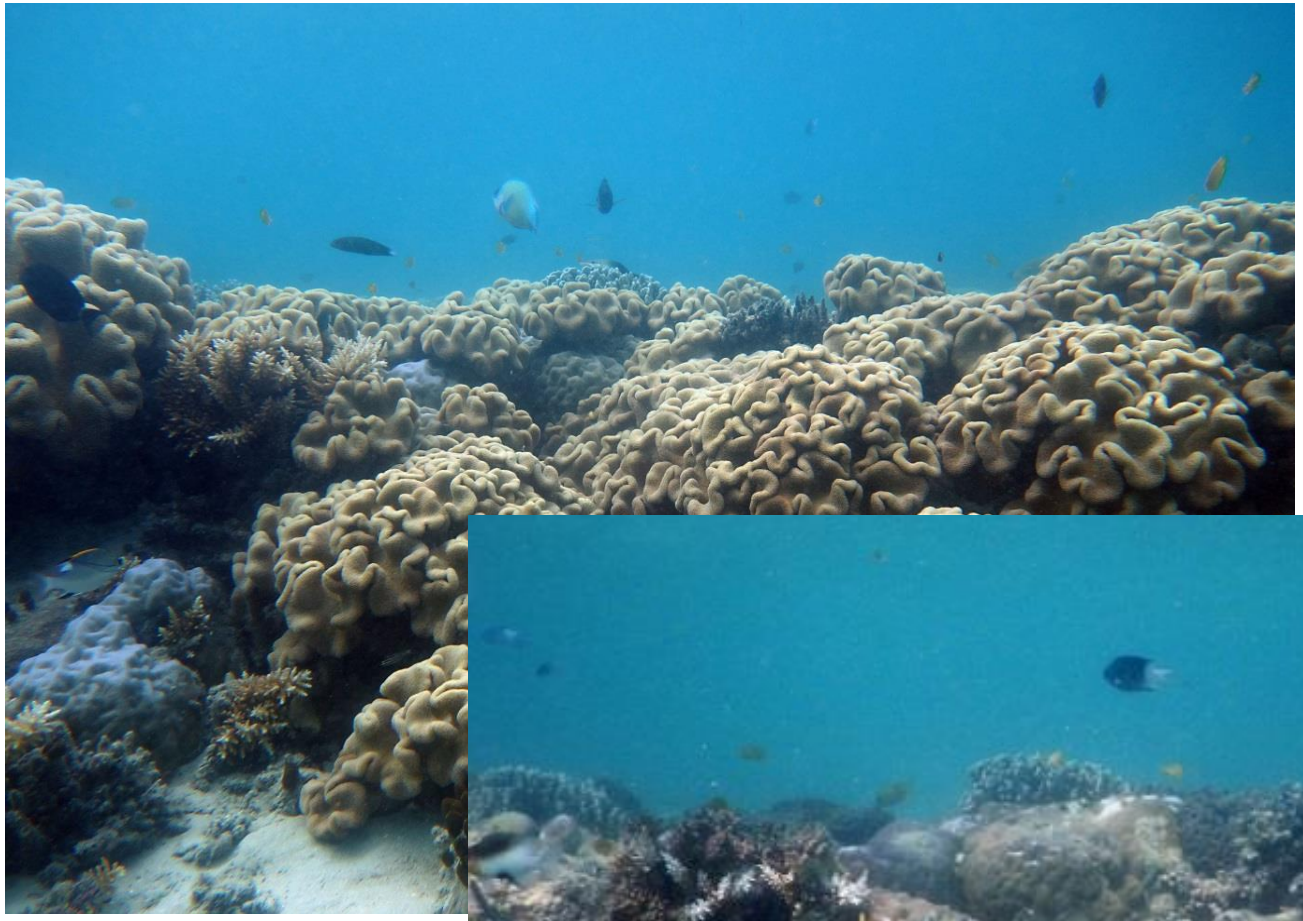
(the worst such event in recorded history)

Source: ARC Centre for Coral Reef Studies

Lizard Island

(photos Anne Hoggett, LIRS)


Water temperature at Lizard Island, 0.6 m depth
29.5°C
2014
Jan
Feb
Mar
29.5°C
2015
Jan
Feb
Mar
29.5°C
2016
Jan
Feb
Mar



Lizard Island

(photos Anne Hoggett, LIRS)

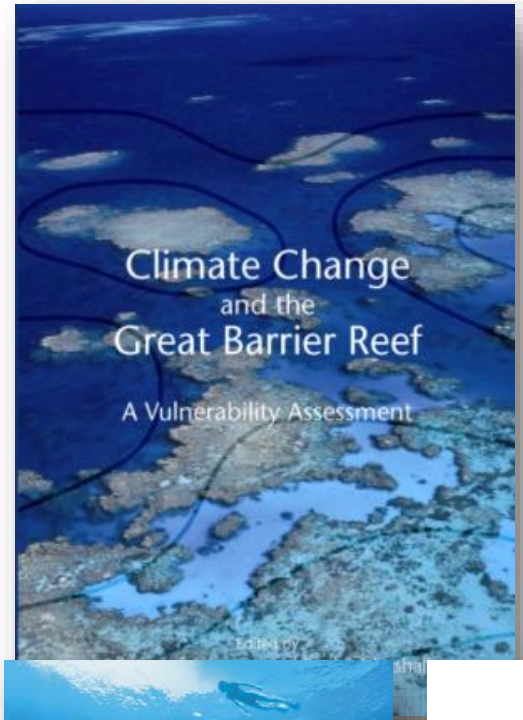
Orpheus Island

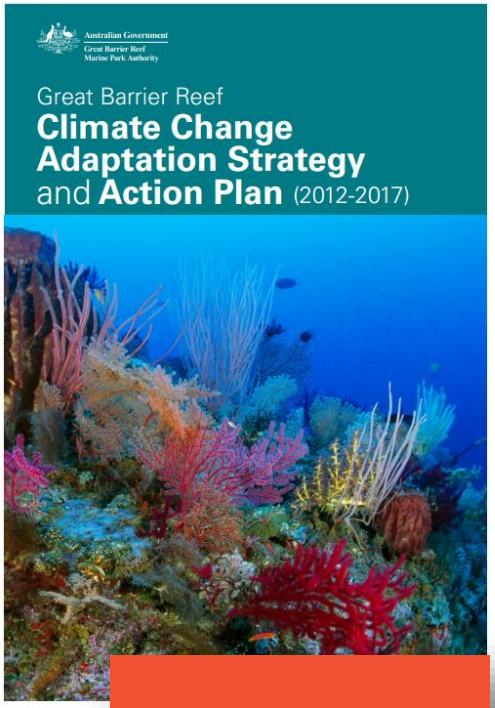
Photo taken 1996

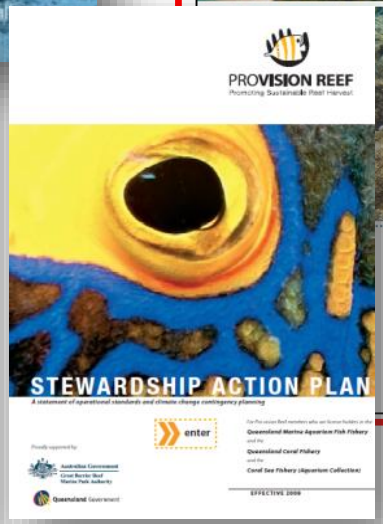
Orpheus Island

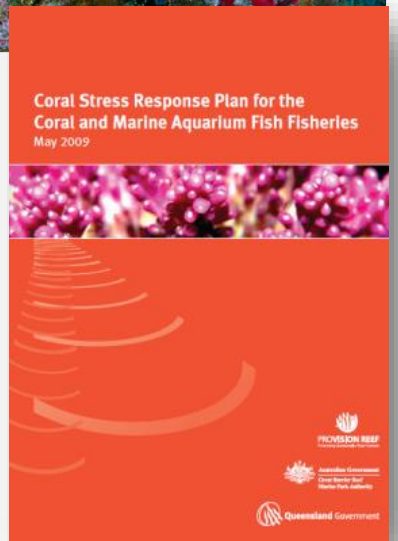
Photo taken 2016

Adapting management to increase resilience





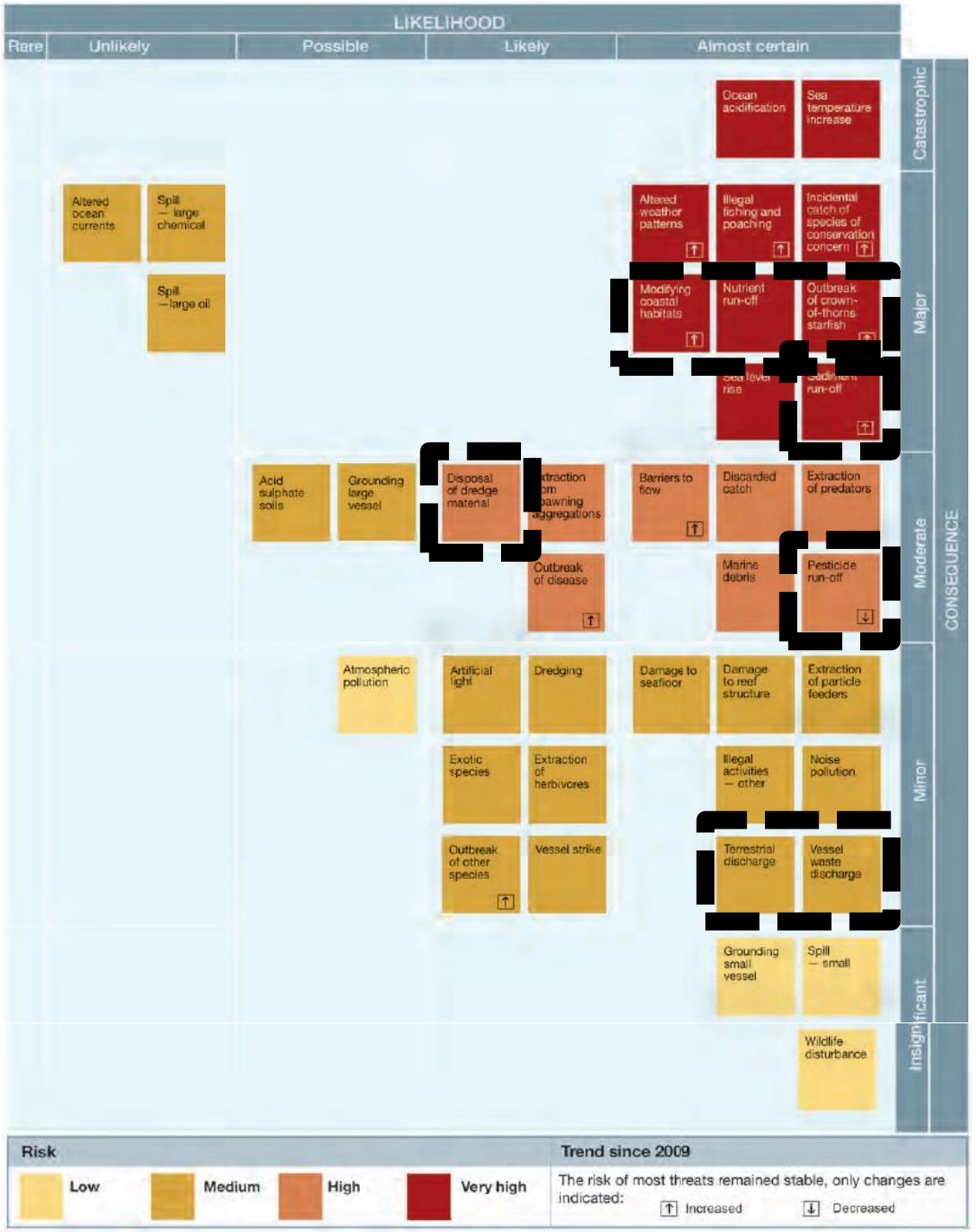




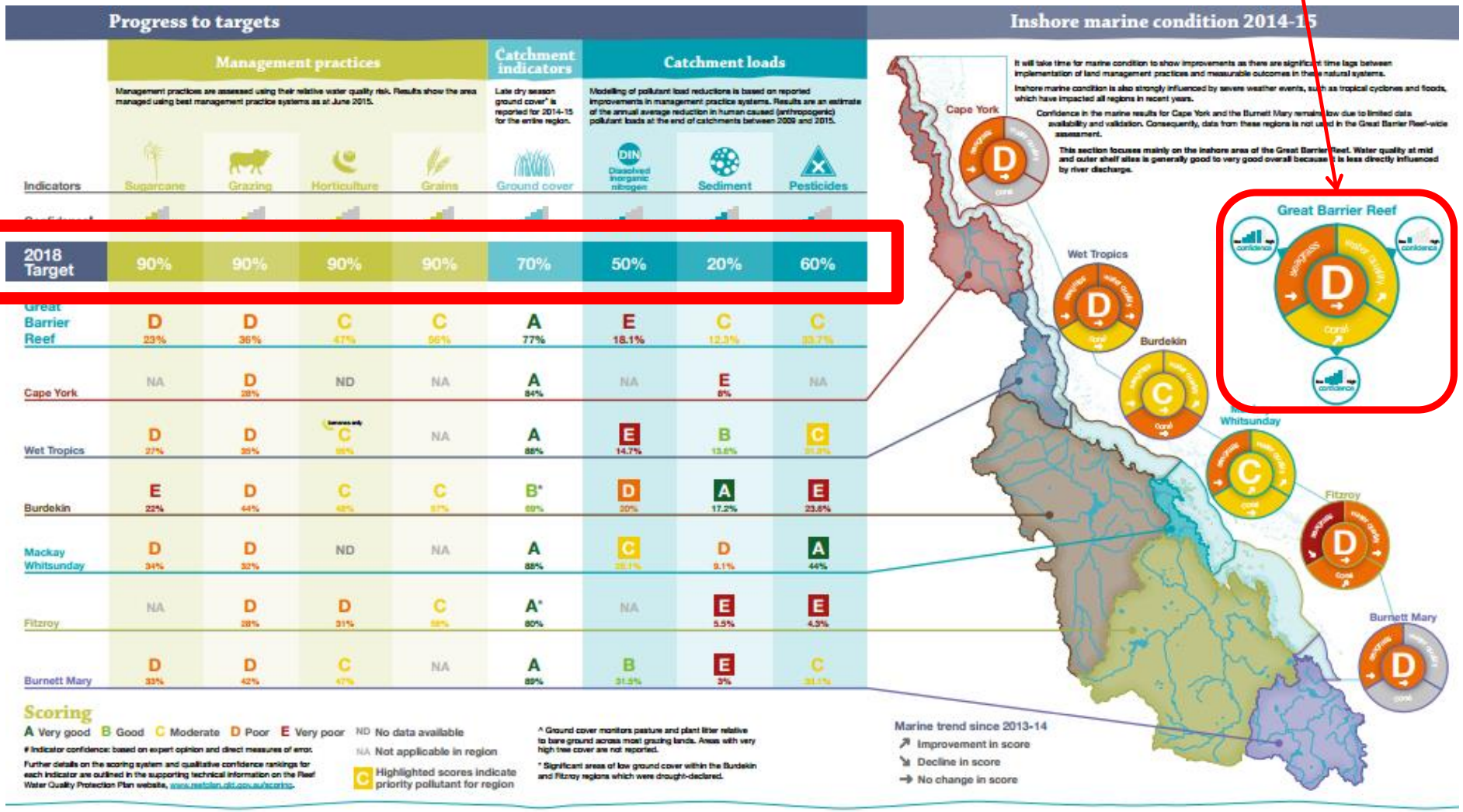
Declining water quality

~ 8 risks

- Nutrient run-off
- Sediment run-off
- Outbreak of COTS
- Modifying coastal habitats
- Pesticide run-off
- Disposal of dredge material
- Vessel waste discharge
- Terrestrial discharge



Great Barrier Reef Report Card 2015 – overall a 'D'!



Inshore marine condition 2014-15

Catchment loads

Modelling of pollutant load reductions is based on reported improvements in management practice systems. Results are an estimate of the annual average reduction in human caused (anthropogenic) pollutant loads at the end of catchments between 2009 and 2015.

DIN Dissolved inorganic nitrogen	Sediment	Pesticides
50%	20%	60%
E 18.1%	C 12.3%	C 33.7%
NA	E 8%	NA
E 14.7%	B 13.8%	C 31.8%
D 20%	A 17.2%	E 23.6%
C 29.1%	D 9.1%	A 44%
NA	E 5.5%	E 4.3%
B 31.5%	E 3%	C 33.1%

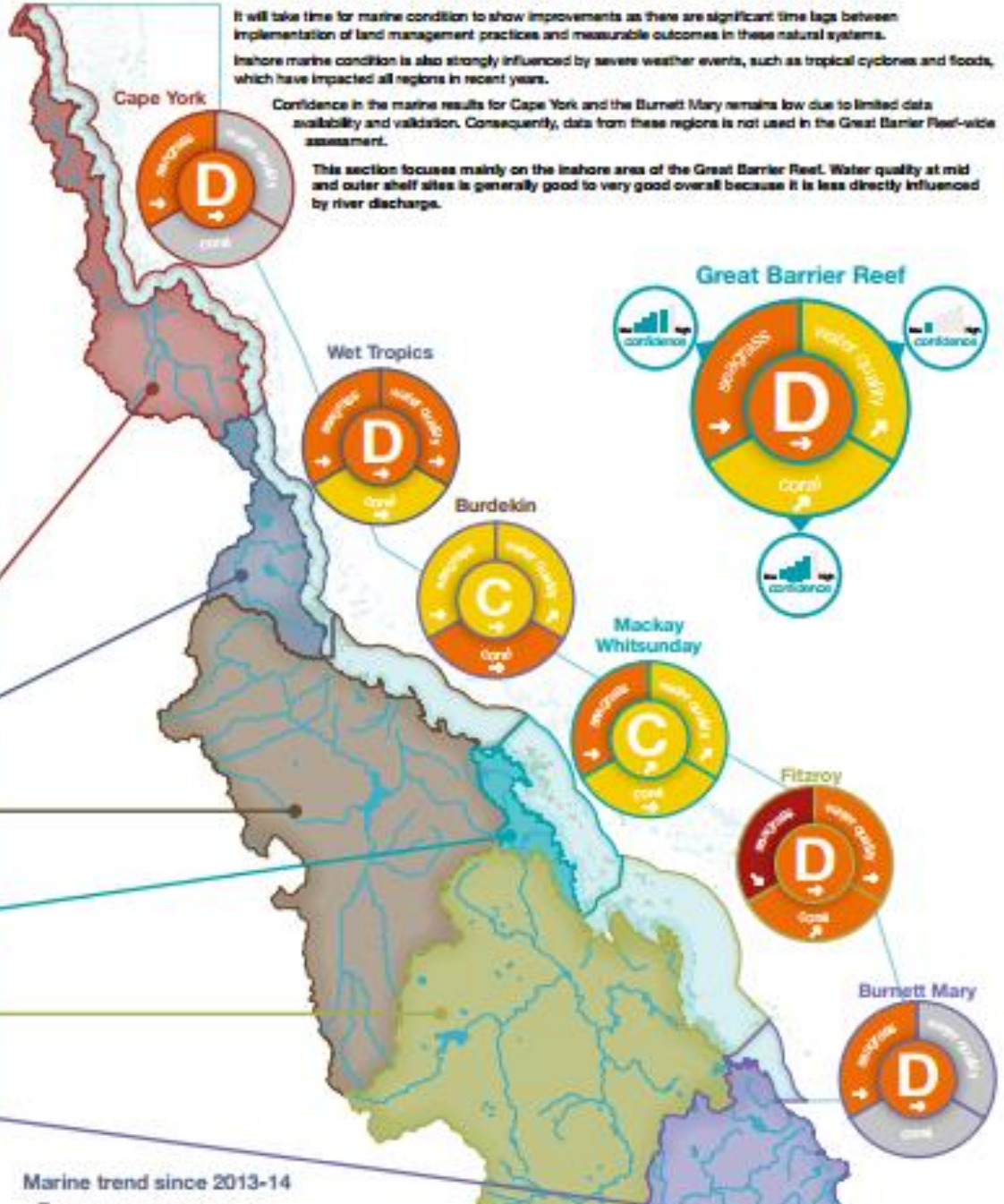
over monitors pasture and plant litter relative

It will take time for marine condition to show improvements as there are significant time lags between implementation of land management practices and measurable outcomes in these natural systems.

Inshore marine condition is also strongly influenced by severe weather events, such as tropical cyclones and floods, which have impacted all regions in recent years.

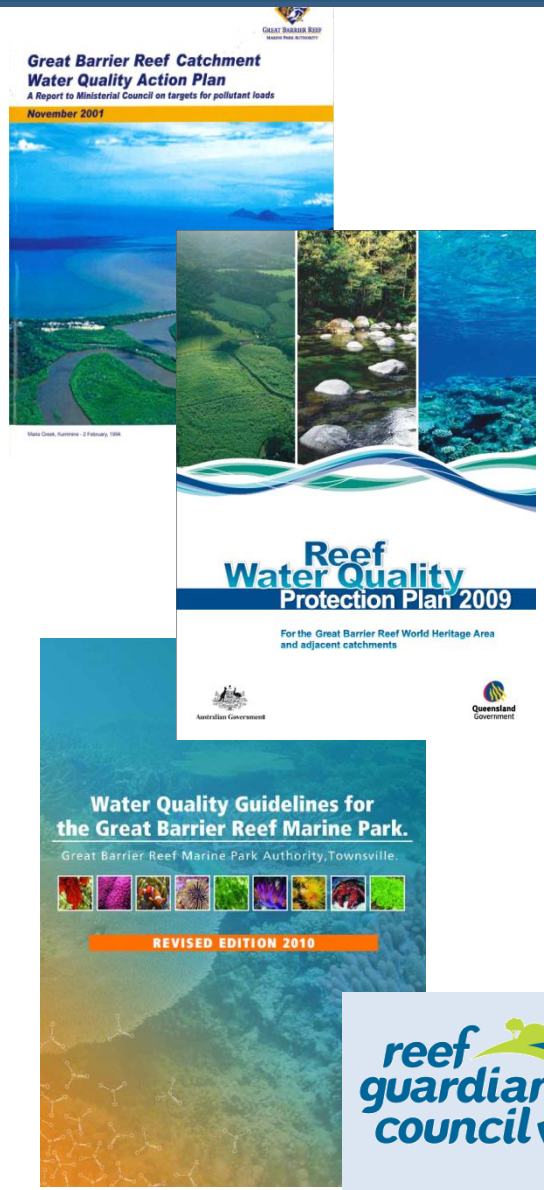
Confidence in the marine results for Cape York and the Burnett Mary remains low due to limited data availability and validation. Consequently, data from these regions is not used in the Great Barrier Reef-wide assessment.

This section focuses mainly on the inshore area of the Great Barrier Reef. Water quality at mid and outer shelf sites is generally good to very good overall because it is less directly influenced by river discharge.



Marine trend since 2013-14

Addressing water quality decline



- Australian and Queensland governments -committed to halt and reverse the decline in water quality entering GBR
- GBR Water Quality Guidelines 2010
- Revised *Reef Plan* included regulation
- Working with Regional bodies/Councils on actions and targets

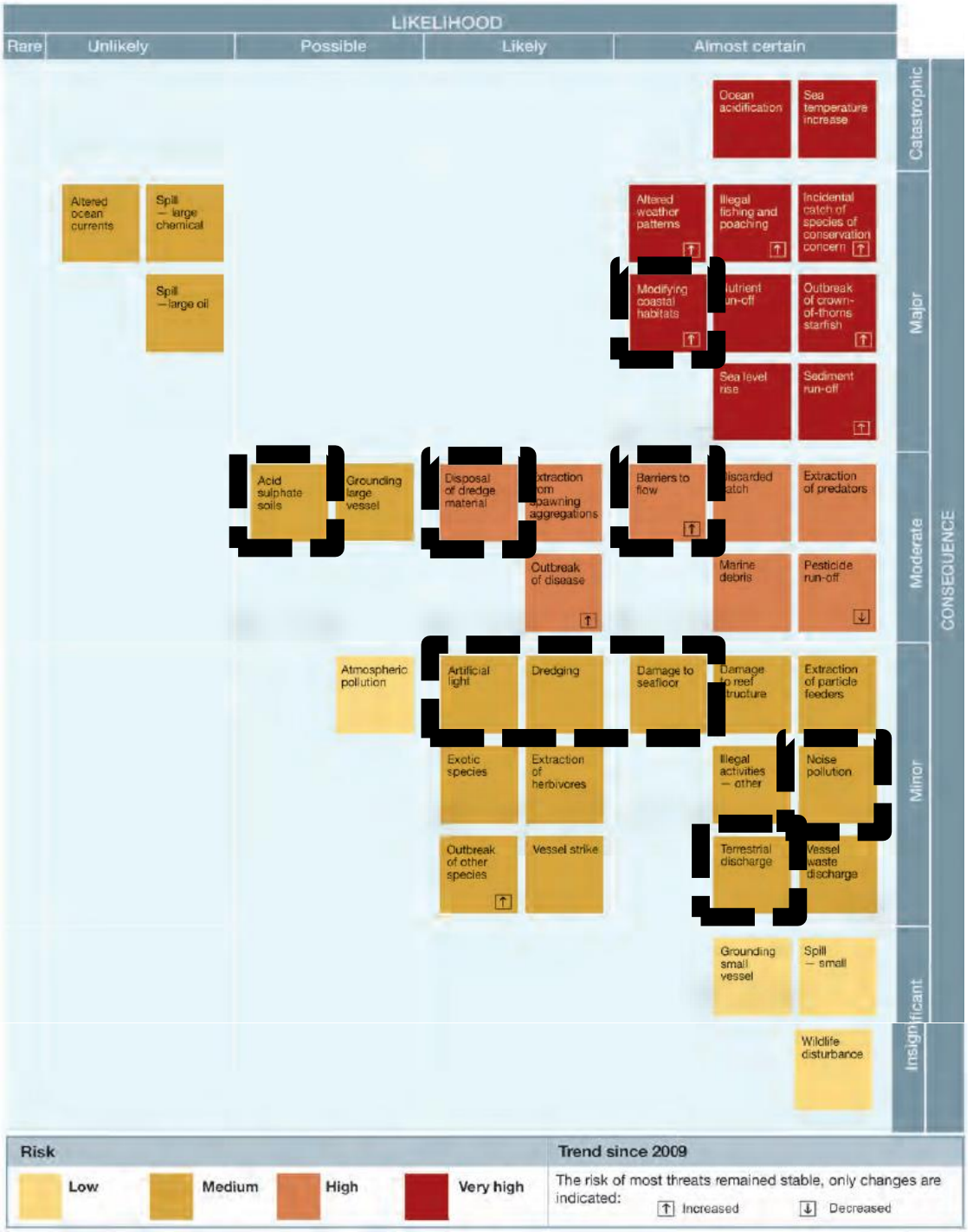
Considerable investment in time and effort ... **but it is far from enough!**

reef guardian council

Coastal development impacting coastal habitats

~ 9 risks

- **Modifying coastal habitats**
- Barriers to flow
- Disposal of dredge material
- Acid Sulphate soils
- Dredging
- Artificial light
- Damage to seafloor
- Noise pollution
- Terrestrial discharge



Coastal developments – *Curtis Island*

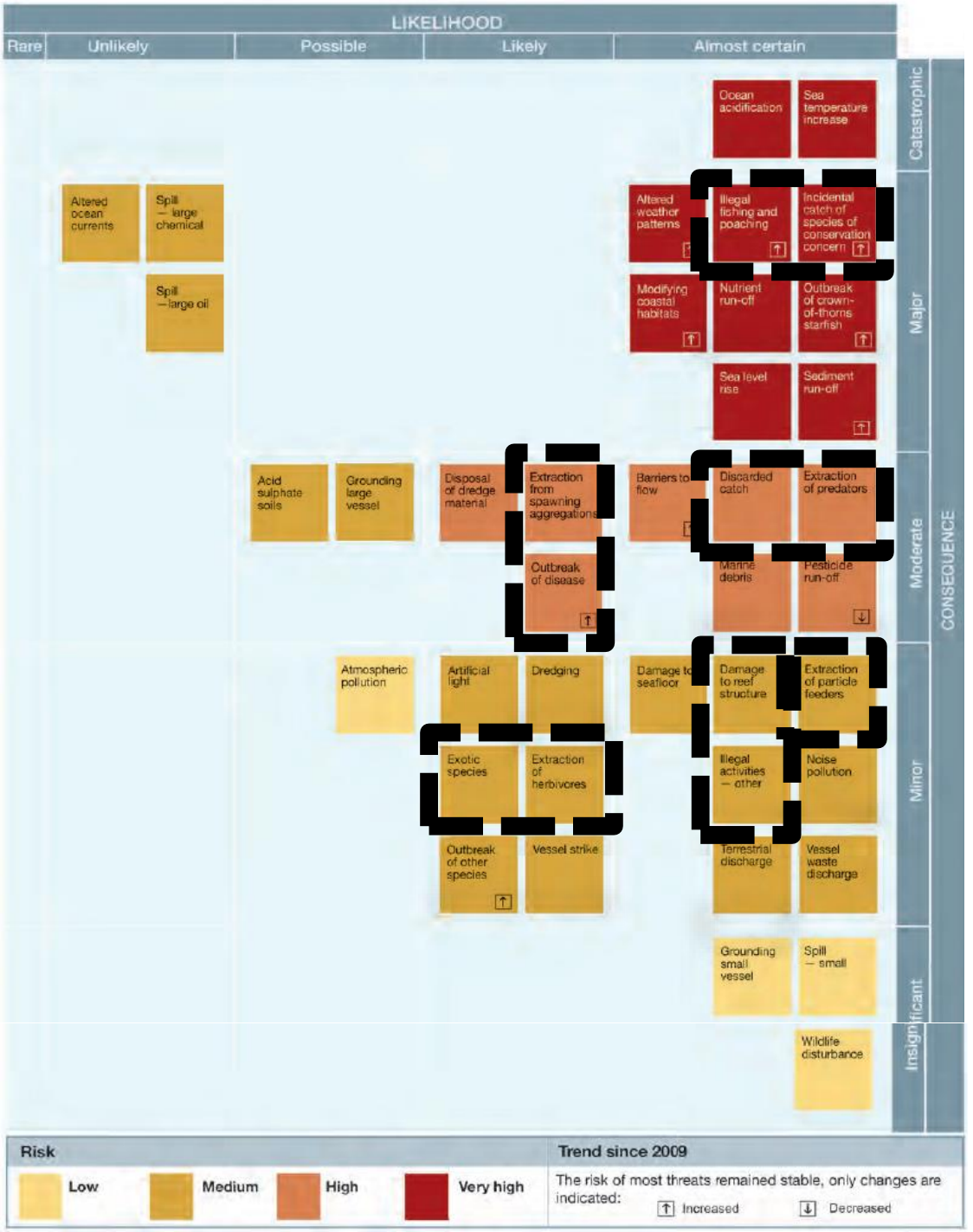
Gladstone Port 2009

Gladstone Port 2016

Unsustainable fishing impacts

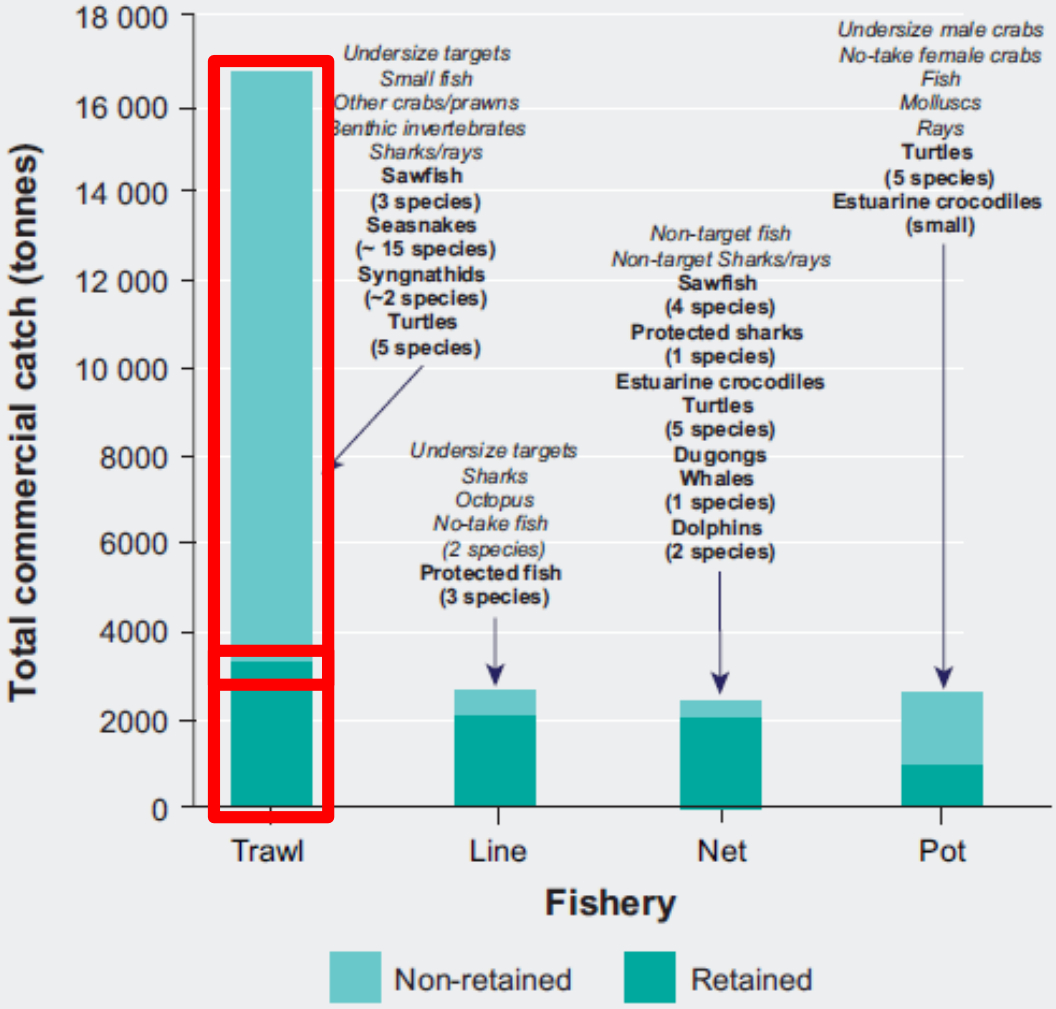
~ 10 risks

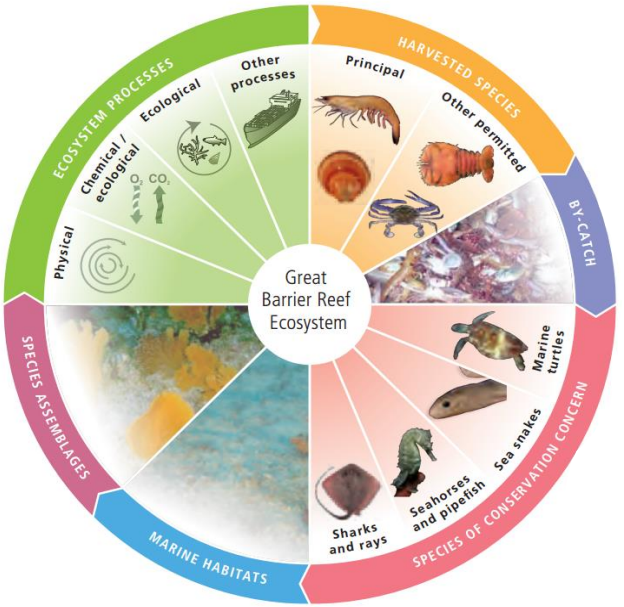
- **Illegal fishing and poaching**
- **Incidental catch of species of conservation concern**
- Extraction of predators
- Discarded catch
- Extraction from spawning aggregations
- Outbreaks of disease
- Extraction of particle feeders
- Extraction of herbivores
- Damage to reef structures
- Introduction of exotic species



Breakdown of commercial fisheries catch in GBR

(Outlook Report, 2009)





Ecological Risk Assessment of the East Coast Trawl Fishery

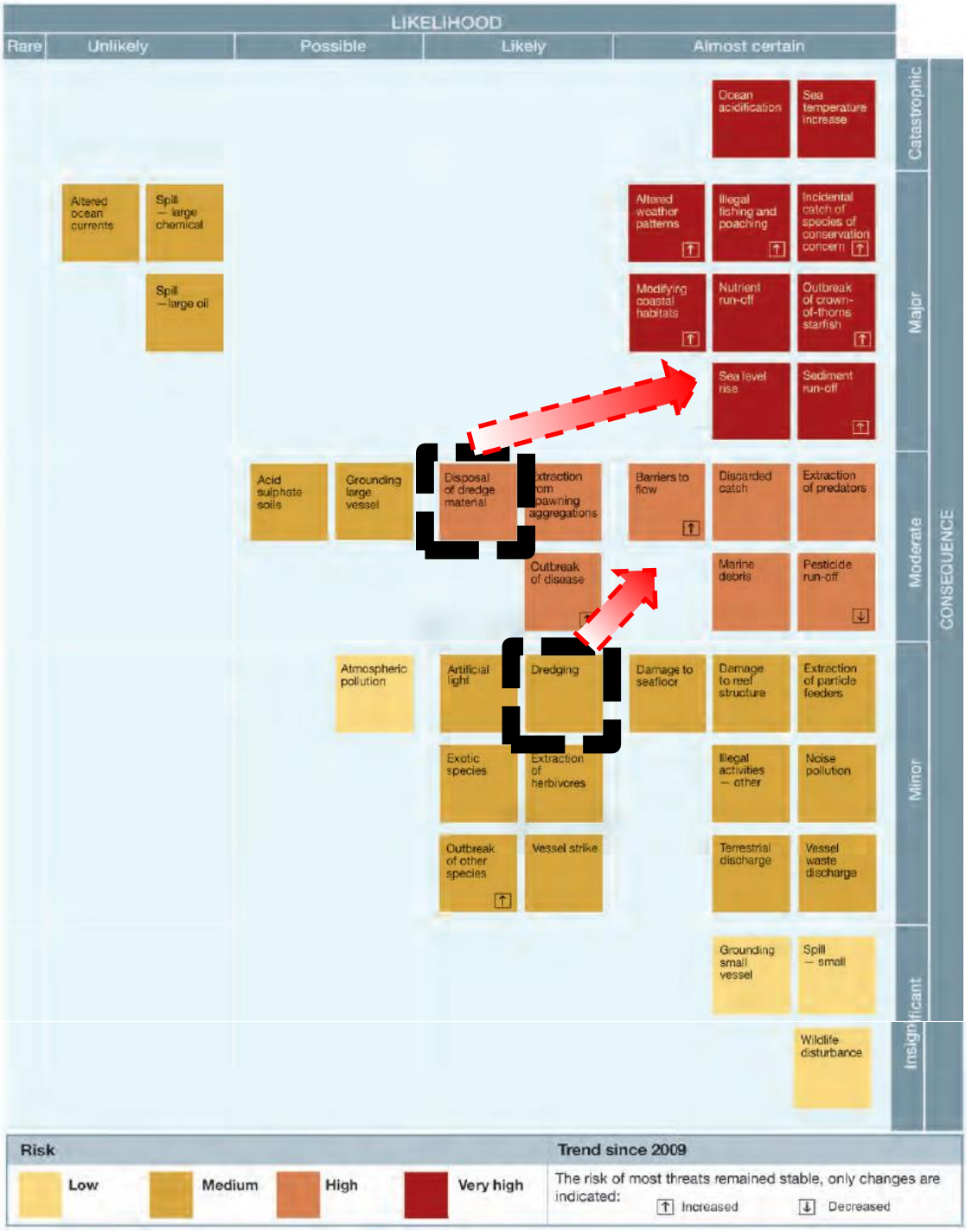
(Pears *et al* 2014)

Dredging and spoil dumping

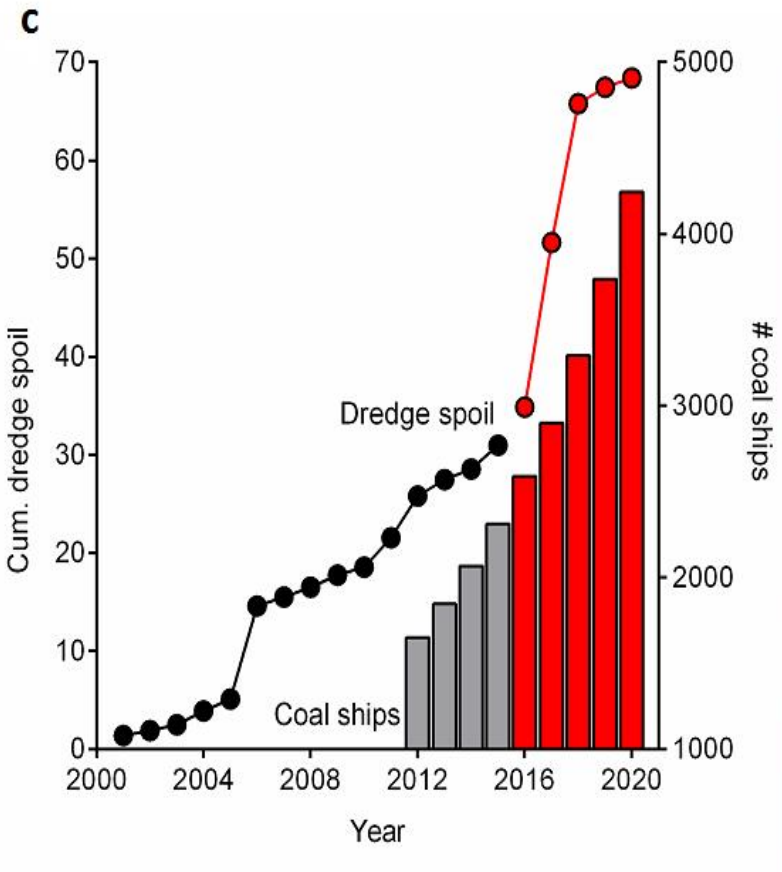
~ 2 risks

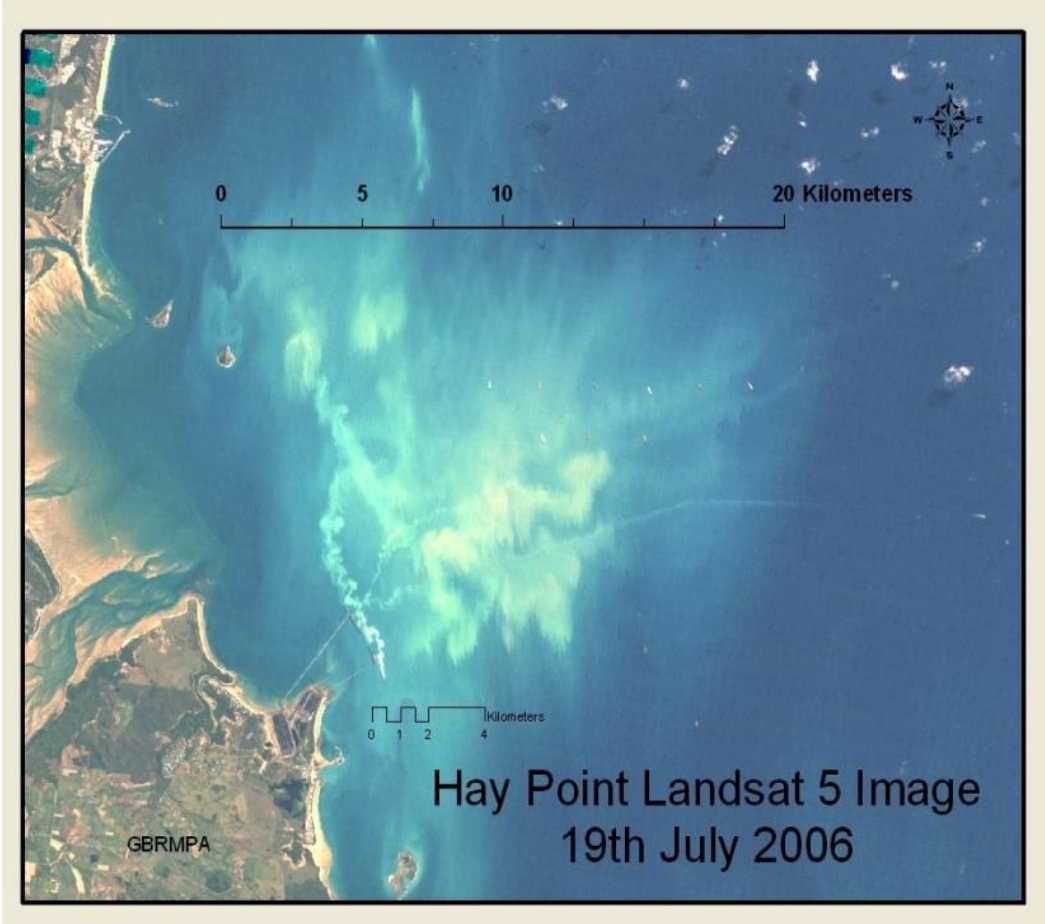
- Disposal of dredge material
- Dredging

… ***but risk levels probably need to be elevated to 'Almost certain', along with increased consequences***



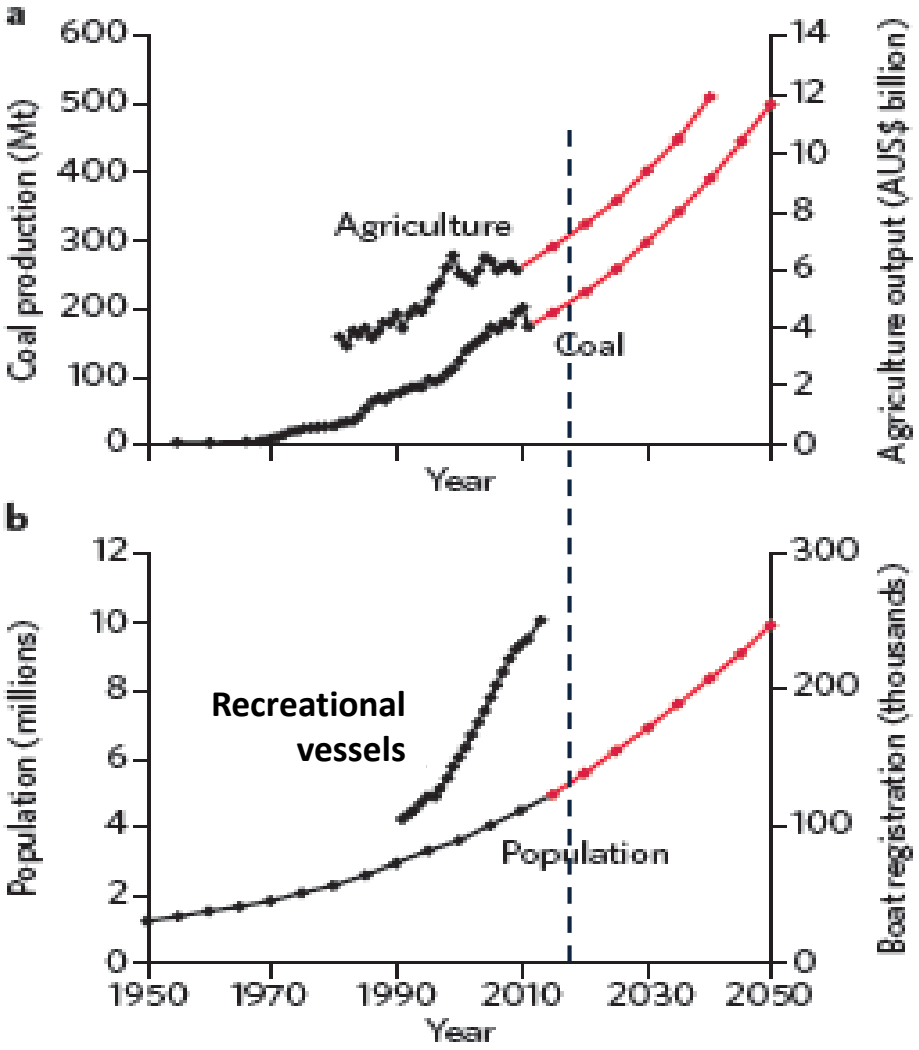
Port dredging and dumping …..and coal ships





Long-term changes in stressors affecting GBR

Observed changes (black); projected changes (red)



Coal production is growing rapidly – projected to <u>treble</u> by 2050

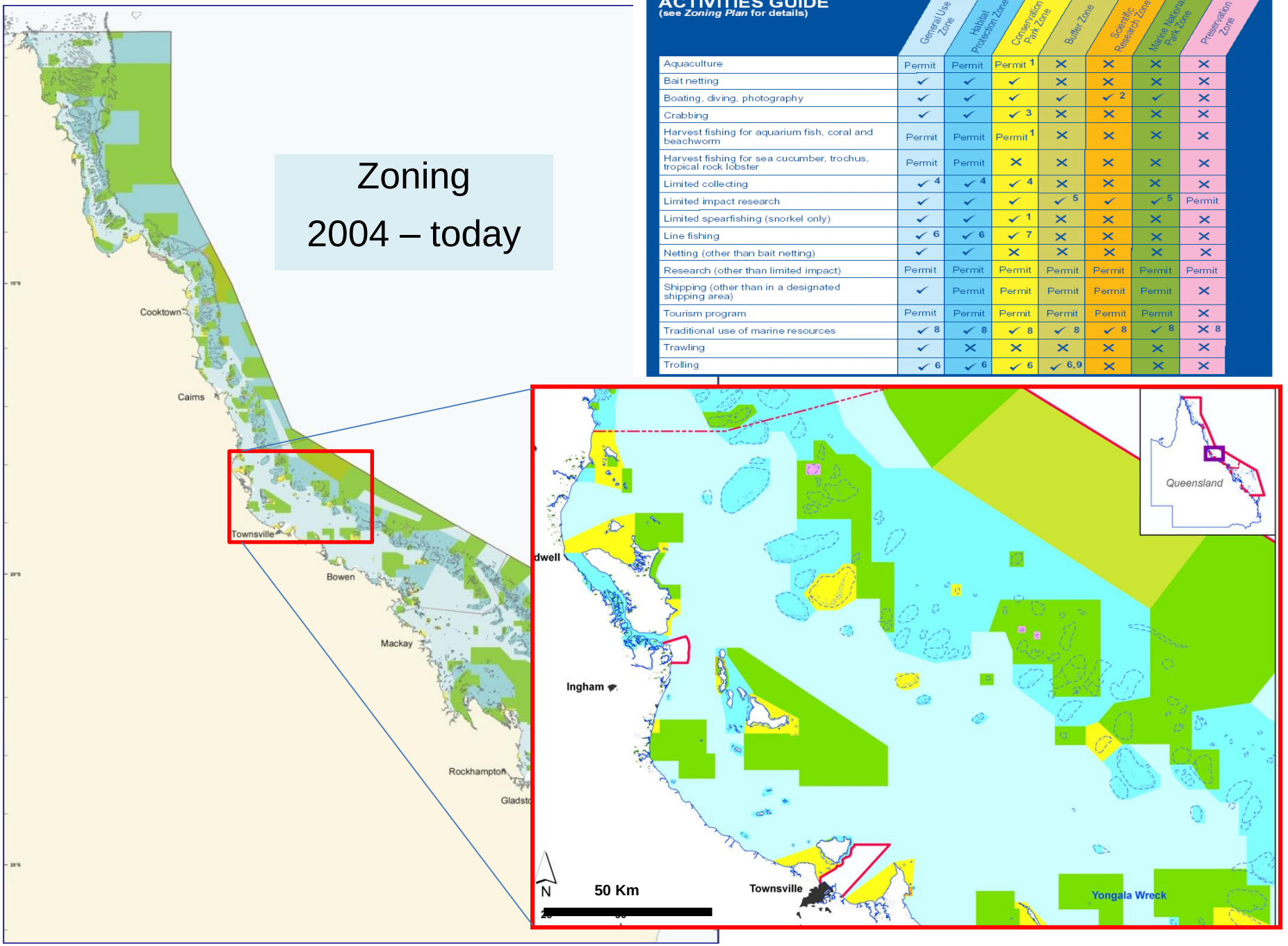
QLD population is growing rapidly – projected to double by 2050

From Hughes, Day and Brodie (2015)
Nature and Climate Change

Zoning
2004 – today

ACTIVITIES GUIDE
(see *Zoning Plan* for details)

	General Use Zone	Habitat Protection Zone	Conservation Park Zone	Buffer Zone	Scientific Research Zone	Marine National Park Zone	Preservation Zone
Aquaculture	Permit	Permit	Permit [1]	✗	✗	✗	✗
Bait netting	✓	✓	✓	✗	✗	✗	✗
Boating, diving, photography	✓	✓	✓	✓	✓ [2]	✓	✗
Crabbing	✓	✓	✓ [3]	✗	✗	✗	✗
Harvest fishing for aquarium fish, coral and beachworm	Permit	Permit	Permit [1]	✗	✗	✗	✗
Harvest fishing for sea cucumber, trochus, tropical rock lobster	Permit	Permit	✗	✗	✗	✗	✗
Limited collecting	✓ [4]	✓ [4]	✓ [4]	✗	✗	✗	✗
Limited impact research	✓	✓	✓	✓ [5]	✓	✓ [5]	Permit
Limited spearfishing (snorkel only)	✓	✓	✓ [1]	✗	✗	✗	✗
Line fishing	✓ [6]	✓ [6]	✓ [7]	✗	✗	✗	✗
Netting (other than bait netting)	✓	✓	✗	✗	✗	✗	✗
Research (other than limited impact)	Permit	Permit	Permit	Permit	Permit	Permit	Permit
Shipping (other than in a designated shipping area)	✓	Permit	Permit	Permit	Permit	Permit	✗
Tourism program	Permit	Permit	Permit	Permit	Permit	Permit	✗
Traditional use of marine resources	✓ [8]	✓ [8]	✓ [8]	✓ [8]	✓ [8]	✓ [8]	✗ [8]
Trawling	✓	✗	✗	✗	✗	✗	✗
Trolling	✓ [6]	✓ [6]	✓ [6]	✓ [6,9]	✗	✗	✗

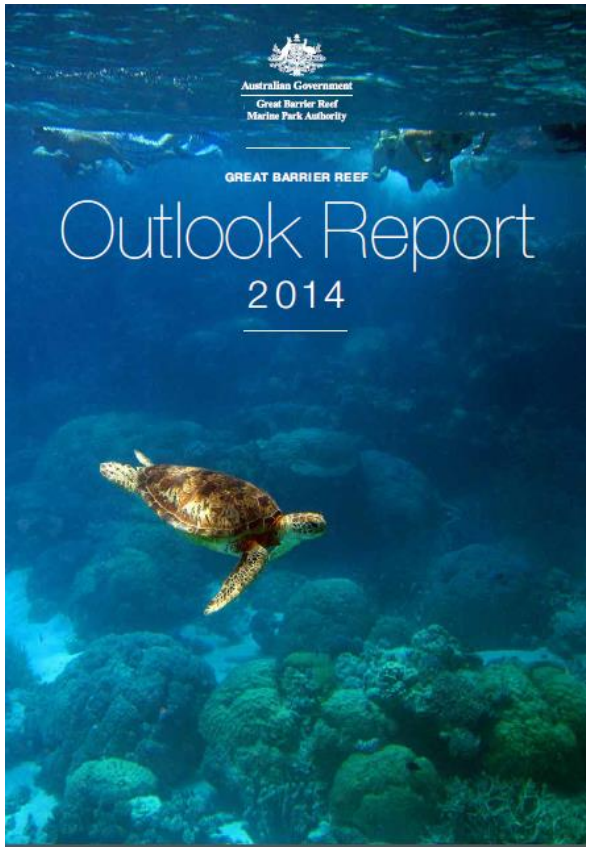


Zoning does not address all the pressures

- **Water Quality** – zoning does not apply outside the marine area where most WQ issues arise
- **Fishing impacts** – zoning addresses some but not all unsustainable fishing impacts
- **Coastal developments, especially ports** – zoning does not apply to ports that are outside the marine park
- **Shipping and pollution incidents** – the zoning plan helps by delineating shipping lanes but does not address ship groundings/pollution
- **Increasing population growth & recreation** – zoning does not address key issues
- **Climate change** – zoning can help build resilience, but does not address acidification or rising sea temperatures

Cumulative impacts

GBR Outlook Report 2014



"Even with the recent management initiatives to reduce threats and improve resilience, ***the overall outlook for the Great Barrier Reef is poor, has worsened since 2009 and is expected to further deteriorate in the future****".*

(Executive summary, p. iv)

The future….?

- **GBR is under unprecedented pressures *(similarly for most MPAs world-wide)* :**
  - **natural**
  - **man-made**
- **Biggest threat is cumulative pressures (both direct and indirect)**
- **Many pressures are likely to increase**
- **GBRMPA needs to prioritize its management in response to these pressures**
- **A possibility of GBR being listed as 'World Heritage in Danger'?**

Email: **jon.day@my.jcu.edu.au**

Webpage: http://www.coralcoe.org.au/person/jon-day