

# Global Change and Australian Coastal Management

Professor Nick Harvey  
The University of Adelaide, South Australia



## Outline of talk

- Global change research
- Global influences on Australian coastal management
- The IPCC
- Coastal vulnerability and sea change
- Calls for national action

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## Global change research organisations

### GLOBAL SCIENTIFIC ORGANISATIONS

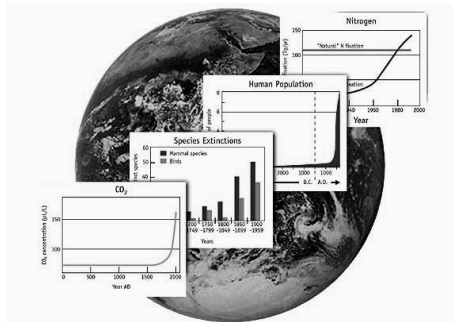
- **International Geosphere-Biosphere Program (IGBP)**
- International Human Dimensions Program (IHDP)
- International Biodiversity program (DIVERSITAS)
- World Climate Research program (WCRP)

### REGIONAL ORGANISATIONS (capacity building for global change)

- **Asia-Pacific Network for Global Change Research (APN) - 21 countries**
- Inter-American Institute for Global Change Research (IAI) - 19 countries

## International Geosphere-Biosphere Program (IGBP formed in 1986)

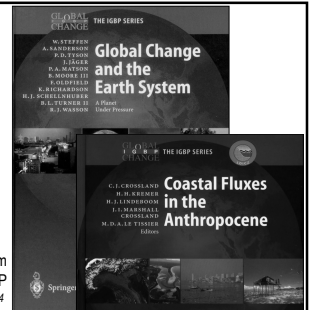
Raises questions about future global sustainability



Source: IGBRS Science 20/2001

## Global Change - synthesis of international scientific research

IGBP research plus contributions from DIVERSITAS, IHDP and WCRP  
Published 2004



Coastal research from LOICZ (Land-Ocean Interaction in the Coastal Zone) project of IGBP  
Published 2005

### Asia-Pacific Network for Global Change Research (formed 1995)



- 21 member countries (including Australia)
- Capacity building for developing countries
- Strong links with other global change organizations
- Scientific and intergovernmental meetings
- APN Coastal research synthesis

COASTAL SYSTEMS AND CONTINENTAL MARGINS  
Global Change and Integrated Coastal Management  
The Asia-Pacific Region  
Edited by Nick Harvey

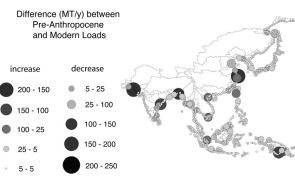


Springer

Published 2006


### Human impact on Asian coasts

"The long-term sustainability of deltas is more affected by large-scale engineering projects than eustatic sea level rise associated with global warming" Syvitski (2008)




Source: Syvitski et al 2005

#### Dams on the Changjiang River, CHINA



#### Three Gorges Dam Changjiang River

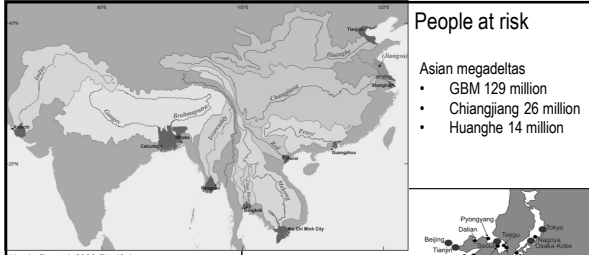


Source: Gao 2006


### People at risk

Asian megadeltas

- GBM 129 million
- Chiangjiang 26 million
- Huanghe 14 million




Woodroffe et al, 2006 Fig 10.1



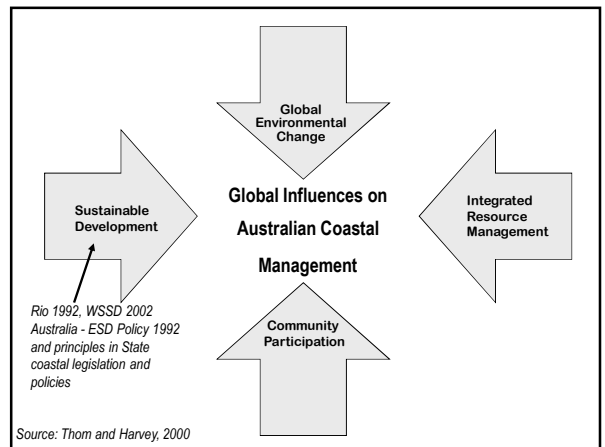
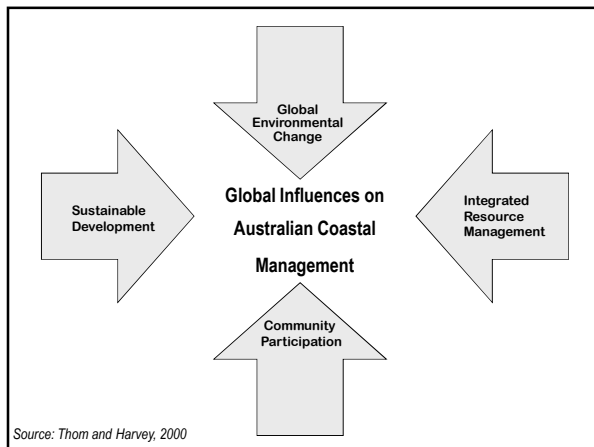
Wong et al, 2006 Fig 7.1

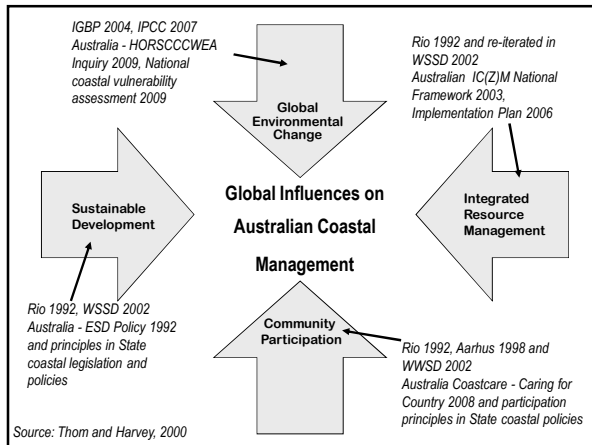
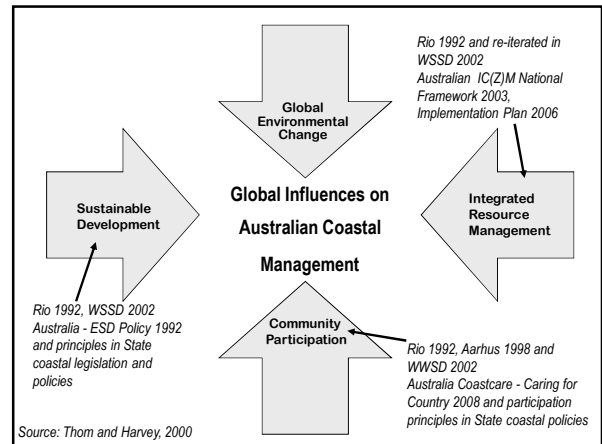
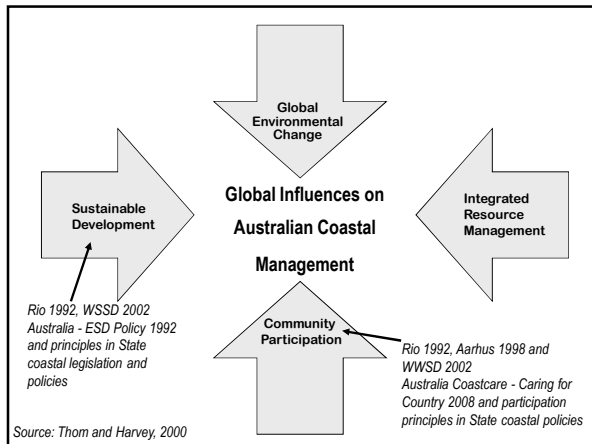
18th NSW Coastal Conference, Ballina, 4-6 November 2009



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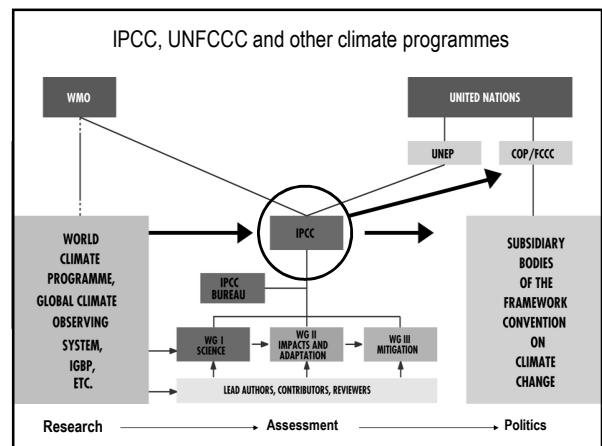
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**INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE**

**Intergovernmental Panel on Climate Change (IPCC)**

- Recognition of climate change as a problem
- Need to understand science behind climate change
- Need to assess extent of human-induced climate change
- Need to understand risks, impacts & options for adaptation & mitigation
- IPCC established in 1988 by WMO and UNEP
- IPCC has 3 working groups plus a task force



### IPCC Assessments to date

First Assessment Report (FAR)	1990
Second Assessment Report (SAR)	1995
Regional Assessment Report	1998
Third Assessment Report (TAR)	2001
Fourth Assessment Report (AR4)	2007

WMO INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE UNEP

### IPCC Working Group structure

**WORKING GROUP I - The Physical Science Basis**  
assesses observed changes in climate, causes of climate change and regional projections

**WORKING GROUP II - Impacts, Adaptation and Vulnerability**  
assesses observed and projected impacts across a range of sectors and regions, adaptation options and residual risks

**WORKING GROUP III - Mitigation of Climate Change**  
analyses near term and long-term options for reducing net greenhouse gas emissions

### IPCC AR4 WGII chapter headings

1. Observed changes & responses in natural & managed systems
2. New assessment methods & future conditions
3. Fresh water resources & management
4. Ecosystems
5. Food, fibre & forest products
6. Coastal systems & low-lying areas
7. Industry, settlement & society
8. Human health
9. Africa
10. Asia
11. Australia & New Zealand
12. Europe
13. Latin America
14. North America
15. Polar regions
16. Small islands
17. Adaptation practices, options, constraints & capacity
18. Links between adaptation & mitigation
19. Key vulnerabilities and risk
20. Perspectives on sustainability

### IPCC Structure for the 4th Assessment Report (AR4) 2007

**Working Group II Co-chairs:**  
Martin Parry (UK)  
Osvaldo Canziani (Argentina)

+ about 160 scientific authors from around the globe

### Preparation of the IPCC AR4 WG II Report

**ZOD = Zero Order Draft** **FOD = First Order Draft** **SOD = Second Order Draft** **TOD = Third Order Draft**

### Preparation of the IPCC AR4 WG II Report

#### Preparing for the Zero Order Draft

**Main tasks**

- Structural consistency
- Writing & editing rules & guidelines
- Prepare draft outline & identify information needs
- organise writing responsibilities & meetings

First meeting of Lead Authors UN Building, Vienna, Austria September 2004



## Preparation of the IPCC AR4 WG II Report

### Ch 11: Australia & New Zealand (meet to write 1st Order Draft)

#### Coordinating Lead Authors

- Kevin Hennessy (Australia)
- Blair Fitzharris (New Zealand)

#### Lead Authors

- Bryson Bates (Australia)
- Nick Harvey (Australia)
- Mark Howden (Australia)
- Leslie Hughes (Australia)
- Jim Salinger (New Zealand)
- Richard Warrick (New Zealand)

#### Review Editors

- Mike Coughlan (Australia)
- Henrik Moller (New Zealand)



Authors in Cairns, March 2005

## Preparation of the IPCC AR4 WG II Report

### Ch 11: Australia & New Zealand - preparing for the 2nd and 3rd Order Drafts

#### 2nd Order Draft

- Re-write 1st Order Draft
- Respond to review comments (1,376)
- Chapter Reviewers involved
- Incorporate new material
- Co-ordinate with other chapters
- Address cross-cutting themes

#### 3rd Order Draft

- Re-write 2nd Order Draft
- Respond to external review comments
- Respond to government review comments
- Chapter Reviewers check on responses
- Incorporate new material
- Co-ordinate with other chapters
- Address cross-cutting themes
- Finalize reference material



Authors in Merida, Mexico, January 2006

## Preparation of the IPCC AR4 WG II Report

### Ch 11: Australia & New Zealand - discussion over Final Draft (Full Report)

#### Summary Report for Policy Makers (SPM)

- Involve participating governments
- Agree 'line by line'
- Changes only with author agreement
- Co-ordinating Lead Authors present

#### Full Report

- Involve participating governments
- Make final revisions to report
- Obtain endorsement during Plenary
- Finalize full report (April 6 - Brussels)



Co-ordinating Lead Authors in Brussels 2006



INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



### IPCC key sections on sea-level rise

#### WORKING GROUP I - The Physical Science Basis

Chapter 10 (section 10.6) 'Sea-level change in the 21st Century'

#### WORKING GROUP II - Impacts, Adaptation and Vulnerability

Chapter 6 (section 6.3.2) 'Climate and sea-level scenarios'

Chapter 6 (section 6.4) 'Key future impacts and vulnerabilities'

Chapter 11 (section 6.4.5) 'Coasts'

## IPCC Fourth Assessment Report, 2007

### Observed sea-level changes

#### GLOBAL

- Global sea-level rose 1961-2003 at average rate of 1.8 mm yr<sup>-1</sup>
- From 1993-2003 the rate was faster 3.1 mm yr<sup>-1</sup> (either accelerated trend or decadal signature?)

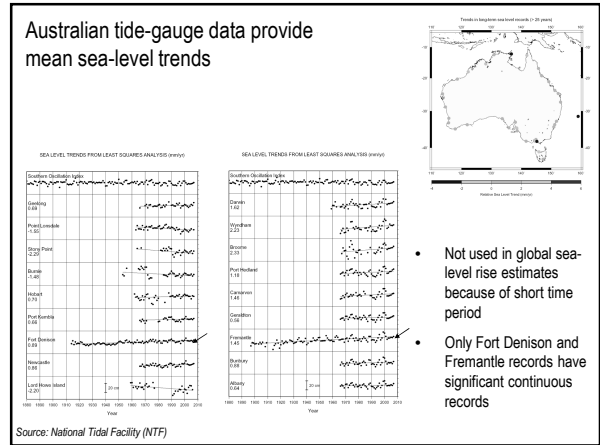
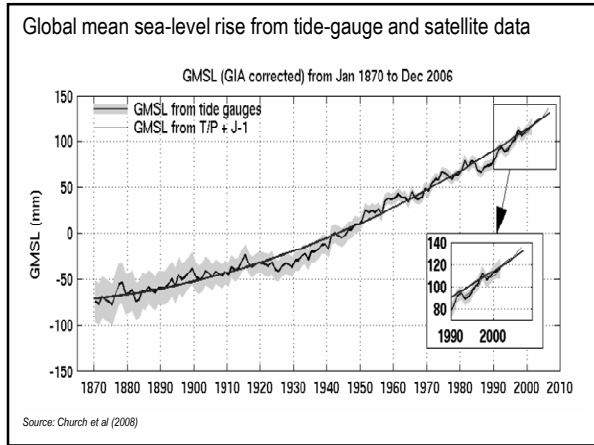
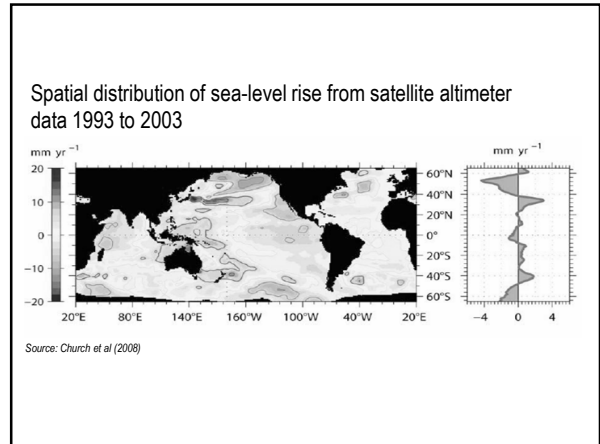
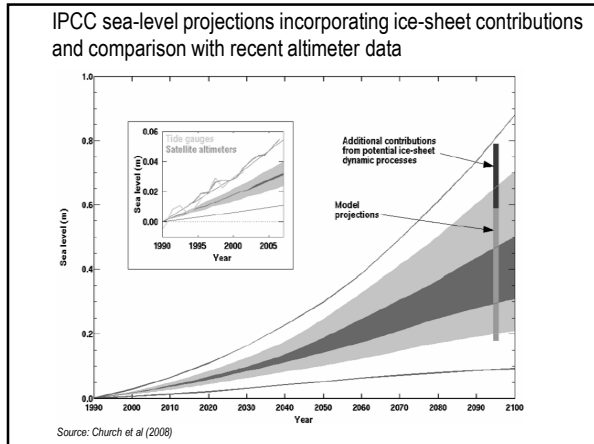
#### AUSTRALIA

- sea level has risen 70 mm since 1950
- Long-term Australian tide gauge records show more frequent extreme sea-level events in the second half of the 20<sup>th</sup> century
- Saltwater intrusion into northern Australian freshwater swamps since the 1950s

## IPCC Fourth Assessment Report, 2007

### Sea-level rise projections

- 0.18 - 0.59 m by 2090-2099 relative to 1980-1999 (reduced range from TAR)
- Sea-level rise would continue for centuries even if greenhouse gases were stabilized
- An additional 0.10 to 0.20 m to allow for uncertainties related to the stability of ice sheets



### Media hype devalues science on vulnerability

**Climate change 'terror'**

**As rain dwindles and dams dry up, one extreme scenario has water, water everywhere (though not a drop to drink)**

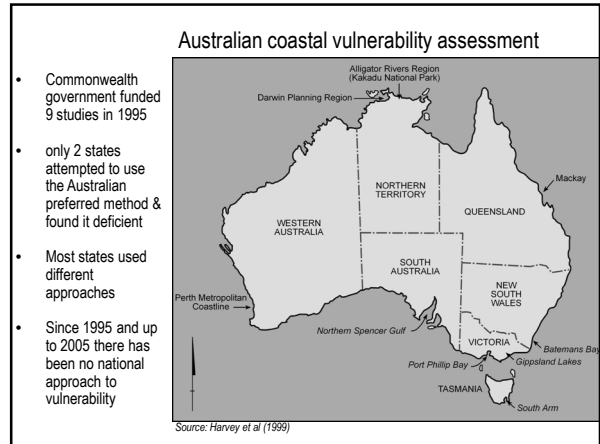
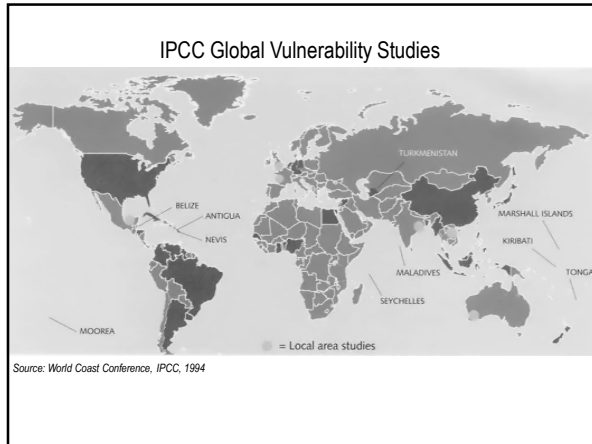
## Dire warning on rising sea levels

CITY BENEATH THE SEA

18th NSW Coastal Conference, Ballina, 4-6 November 2009

### Outline of talk

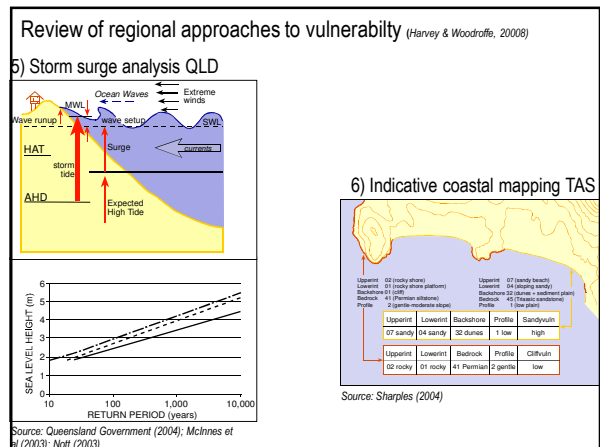
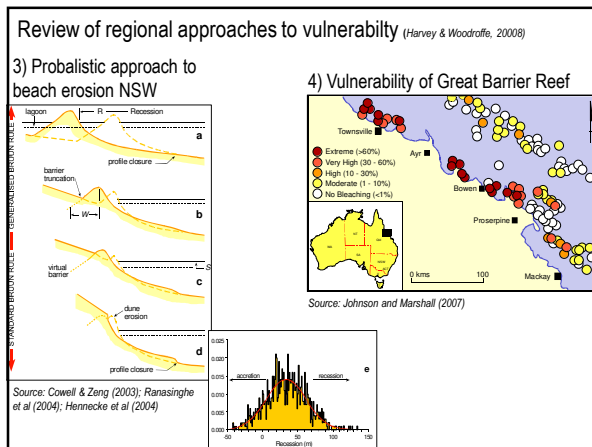
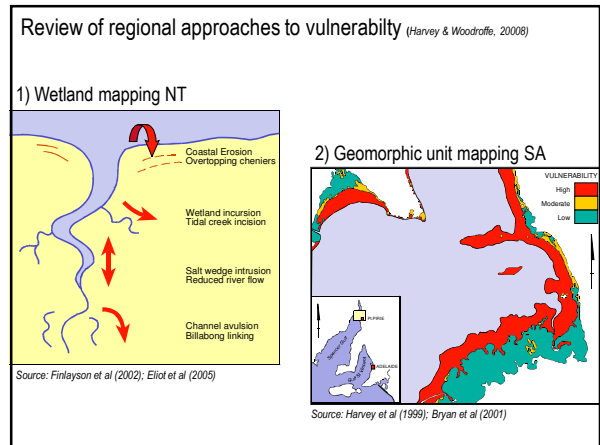
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18th NSW Coastal Conference, Ballina, 4-6 November 2009

### New vulnerability studies 2000 onwards

- Regional storm surge (current) risk assessment studies
- Climate change projected storm surge studies
- State based coastal vulnerability study
- Insurance industry study on population at risk
- Coastal modelling studies
- Flood risk studies



## Recent Australian Government Initiative on Vulnerability

### Former Australian Greenhouse Office (AGO)

- AGO commissioned background studies in 2005
- December 2005 AGO held Coastal Vulnerability Workshop
- AGO prepared 2 more studies in 2006
  - 1) International Methods Review
  - 2) Review and Gaps Analysis for Australia

## Australian Coastal Vulnerability Review and Gaps Analysis

### Needs for vulnerability studies

- Improved accuracy for shoreline position and near-shore elevation
- Digital elevation matched to near-shore digital bathymetry
- Collated set of visual records (historical and recent) for beaches, dunes, estuaries, river outlets and past storm damage
- Survey of national status of planning schemes and local ability to use climate change information in planning
- Common set of information for the coastal ecosystem

### Recommendation

- Conduct 'first pass' national vulnerability over 1-2 years

Source: Voice, Harvey & Walsh (2006)



## Other Australian National Vulnerability Approaches

### Institution of Coastal Engineers

- Developed national guidelines for responding to sea-level rise (revised 2004))

### Insurance Council of Australia

- Commissioned national vulnerability study (Leigh and Chen, 2006)
- Used geo-coded national address file (GNAF)
- Shuttle Radar Topography Mission (SRTM) elevation data
- 5 m resolution DEMs for some east coast cities to validate SRTM

### Results

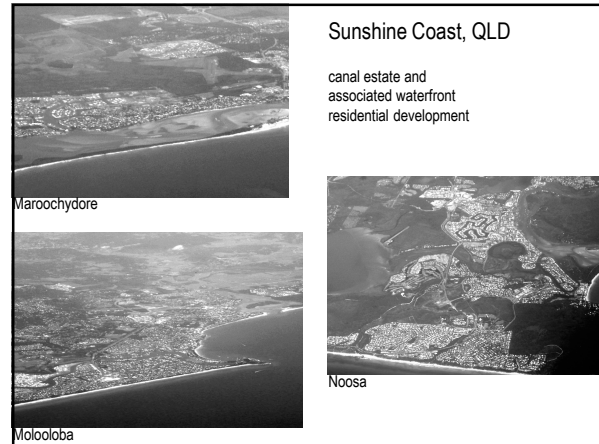
- About 711,000 addresses below baseline elevation of 6 m
- 60% of these in Queensland and New South Wales

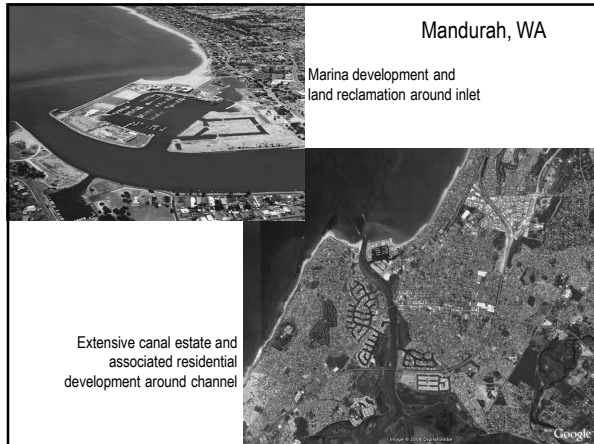
18th NSW Coastal Conference, Ballina, 4-6 November 2009



## Sea change

1. Coastal population outside capital cities 4.9 to 5.9 million 1996-2006
2. 79% of Australia's regional population
3. Cumulative growth since 2001 9.8% compared with national rate of 6.1%
4. Another million 'baby boomers' estimated to move by end of decade
5. Rate of growth not sustainable



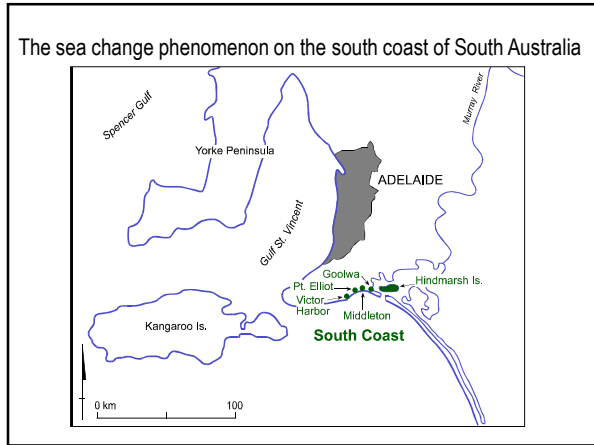


### Local government responds to the sea change phenomena

Report No. 2 for the NATIONAL SEA CHANGE TASKFORCE  
January 2006

#### Sea Change Taskforce

- formed in 2004
- 60 member councils
- represents around 4 million people
- Commissioned a number of studies
- Holds sea change conferences
- Aims to develop national approach with all tiers of government



18th NSW Coastal Conference, Ballina, 4-6 November 2009

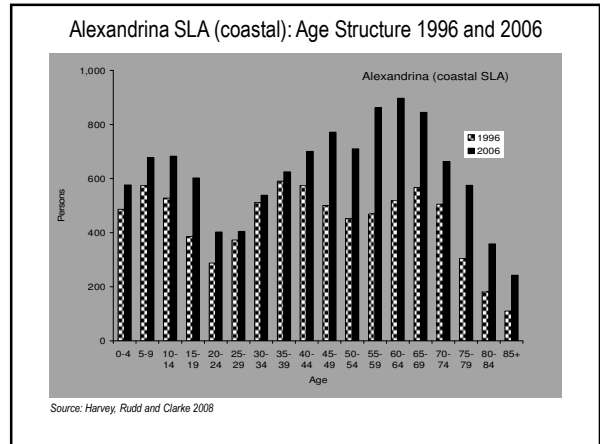
### Population change and development on the South Coast

- Major marina and waterfront development at Hindmarsh Island, near Goolwa (1052 allotments)
- Middleton (classic sea change town)
- 300% population increase at Victor Harbor over last 20 years
- Two waterfront developments at Victor Harbor
  - Encounter Lakes (495 allotments)
  - Franklin Harbor (110 allotments)
- Change in style of development over last 20 years with waterfront and leisure type allotments such as McCracken Resort (and golf course) and 'Beyond Today' subdivision (220 allotments)

### Rapid coastal development, south coast SA over last 20 years

Hindmarsh Island marina, near Goolwa - extensive housing development (1052 allotments)

Middleton coastal development, SA (referred to by Salt (2008) as a classic sea change town)

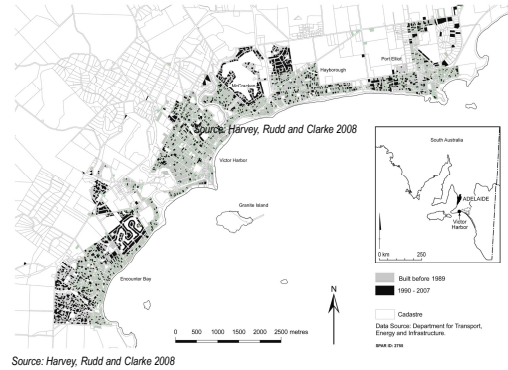




Age profile of residents visiting the local pub in Goolwa?



Victor Harbor/Port Elliot, SA - subdivisions 1990-2007



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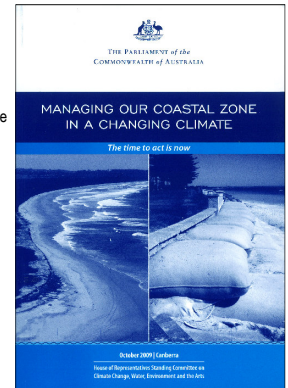


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Monday 26 Oct (last week)

Release of Inquiry (368 pages) by the House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts (HORSCCCWEA)





18th NSW Coastal Conference, Ballina, 4-6 November 2009

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### House of Representatives Coastal Report

FINDINGS

- Vast number of competing users involved in coastal management
- Decisions on the coast made on individual 'ad hoc' basis
- No co-ordination of Commonwealth activities on the coast

RECOMMENDATIONS

- Establish an Australian Coastal Management Council
- Commonwealth together with the States to develop and promulgate national policies and objectives for conservation and preservation of the coast

18th NSW Coastal Conference, Ballina, 4-6 November 2009

THE UNIVERSITY OF ADELAIDE AUSTRALIA

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### Australian calls for institutional integration

	HOR (1991)	ESD (1992)	RAC (1993)
National coastal strategy	✓	✓	✓
Intergovernmental agreement on coast	✓	✓	✓
Integration of Commonwealth and state	✓	✓	✓
Community - citizen participation	✓	✓	✓
Commonwealth coastal legislation	✓		✓
Finance to state/local government	✓		✓
Integration of local government	✓		✓
Regional basis to management		✓	✓
Commonwealth coastal agency			✓

(Source: Haward, 1995)

18th NSW Coastal Conference, Ballina, 4-6 November 2009

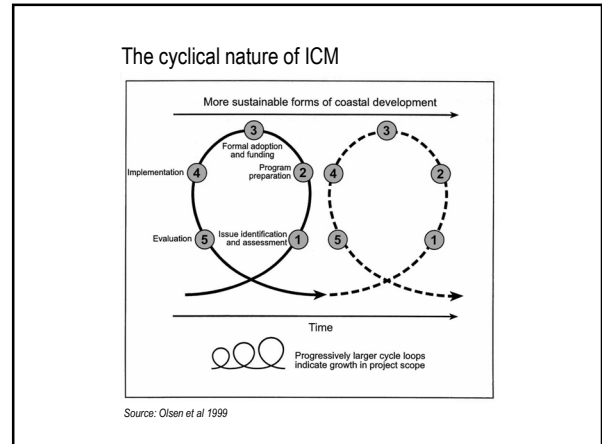
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### House of Representatives Report notes need for integration

(already recognised internationally)

*Each coastal State should consider establishing, or where necessary strengthening, appropriate coordinating mechanisms ... for integrated management and sustainable development of coastal and marine areas and their resources, at both the local and national levels.*

(Agenda 21, Chapter 17.6, 1992)

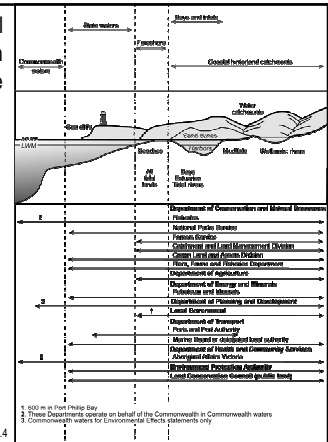




### Need for integration - in Australia

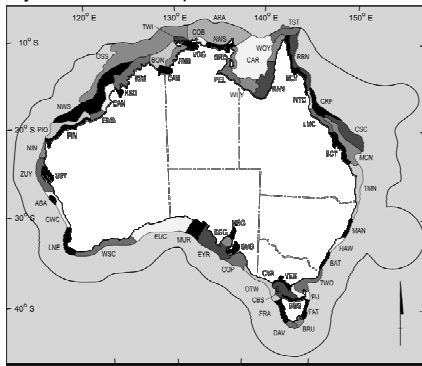
- Land-based overlap of jurisdictions
- Sea-based overlap of jurisdictions
- Oceans Policy system of bio-regions
- Problems occur at inter-state and intra-state levels
- Major problem with 'tyranny of small decisions'

### Land-based jurisdictional overlaps in the Victorian coastal zone



Source: Harvey and Caton, 2003, Fig 4.4

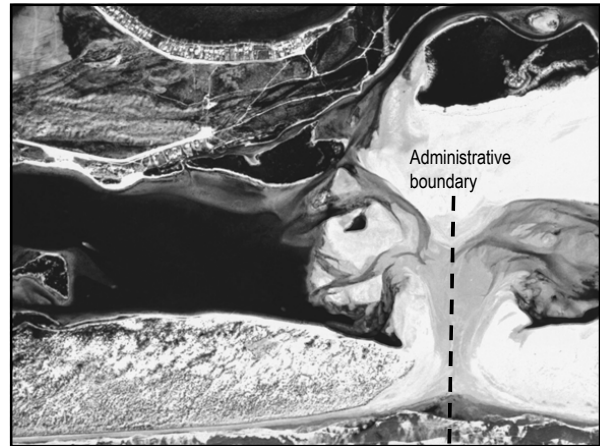
### 60 bioregions as a basis for representative system of marine protected areas



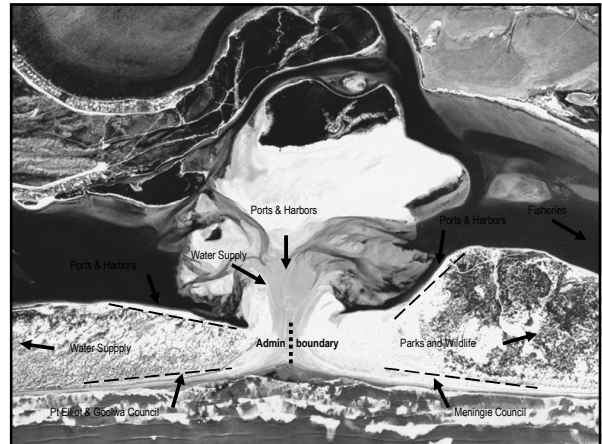
Source: Harvey and Caton, 2003, Fig 4.15




Source: Harvey and Caton, 2003, front cover







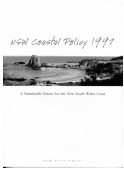
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### Tyranny of small decisions


- A local authority permits a small coastal development
- Many neighboring authorities taking similar decisions resulting in unforeseen cumulative impact
- Similar effect occurs within governments where individual agencies make separate coastal-related decisions
- Small decisions require a broader strategic framework in which they are made

### Signs of integration in State Government coastal plans and policies



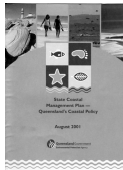
NSW Coastal Policy 1997

*has a strong integrating philosophy based on the principles of Ecologically Sustainable Development*



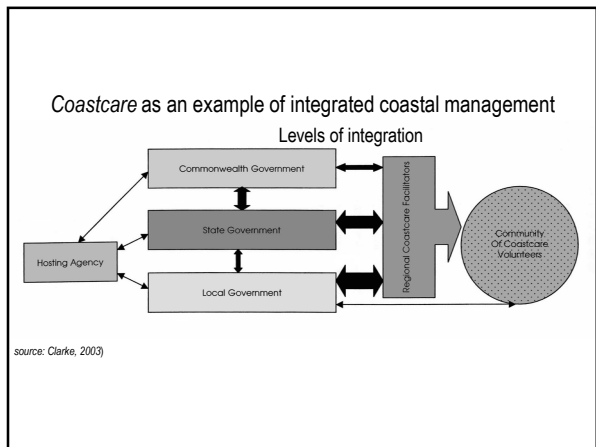
Victorian Coastal Strategy 2002

*encourages an integrated approach to coastal management*



The Queensland State Coastal Plan 2001

*seeks to establish a coordinated and integrated framework...*



### Australian Government approach to Integrated Coastal Management Framework (2003) and Implementation Plan (2006)

NATIONAL COOPERATIVE APPROACH TO INTEGRATED COASTAL ZONE MANAGEMENT  
FRAMEWORK AND IMPLEMENTATION PLAN



### Australian Integrated Coastal (Zone) Management

Framework for National ICZM Cooperative Approach (2003)

Implementation Plan (2006) - (has 6 priority areas)

1. Integration across catchment-coast-ocean continuum
2. Land and marine based sources of pollution
3. Climate change
4. Pest plants and animals
5. Planning for population change
6. Capacity building



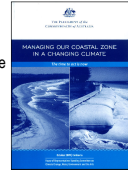
### Last week's House of Representatives Report

KEY MESSAGE

- National leadership needed in managing our precious coastal zone in the context of climate change

THEMES FOR RECOMMENDATIONS

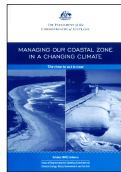
1. International coastal governance (R 1)
2. Climate change science and coastal impacts (R 2-4)
3. Adaptation strategies and practices to promote resilience (R5-18)
4. Insurance planning and legal issues (R19-23)
5. Sustainable coastal communities and environmental impacts (R24-37)
6. Governance arrangements in the coastal zone (R38-47)



### Last week's House of Representatives Report

SOME KEY RECOMMENDATIONS

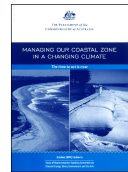
- An intergovernmental agreement on the coastal zone
- A National Coastal Zone Policy and Strategy
- A Coastal Zone Ministerial Council
- A nationally consistent sea-level rise planning benchmark
- Extend the first pass vulnerability assessment to second and third stages
- A system of national coastal zone environmental accounts
- Further studies into a) international coastal governance, b) impacts of climate change and related insurance matters, c) human and resource needs of local governments



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http://www.australiancoastsociety.org



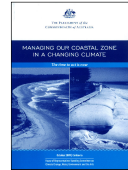
### Models for coastal zone management

Dr Wescott's national coastal policy (page 276)

- National Ocean and Coasts Act
- Statutory Australian Coastal Strategy
- Statutory Australian Coastal Council
- Coastal resourcing policy

Professor Thom's five-step model (page 278)

- National Coastal Policy
- A Coastal Zone Management Act
- A Federal Coastal Agency
- A federal science agency to manage coastal information systems
- A Coastal Advisory Council

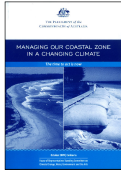




Last week's House of Representatives Report

SOME KEY RECOMMENDATIONS

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- Extend the first pass vulnerability assessment to second and third stages
- A system of national coastal zone environmental accounts
- Further studies into a) international coastal governance, b) impacts of climate change and related insurance matters, c) human and resource needs of local governments



Poor coastal planning



Source: RAC Coastal Inquiry, 1993



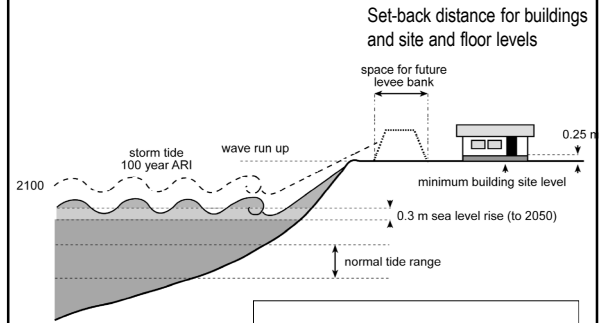
Each state has a different policy on sea-level rise planning

- NSW draft policy 0.9 m to 2100
- QLD draft plan 0.8 m to 2100
- SA 0.3 m to 2050 and 1.0m to 2100 (under revision - proposed higher levels)
- TAS state coastal policy under revision
- VIC 0.8 m to 2100
- WA policy review may include 0.8 m to 2100

(note Extract from Planning for Coastal Change by Barbara Norman is included in the appendices to the HORSCCWEA Report)

South Australian Policy related to sea-level rise

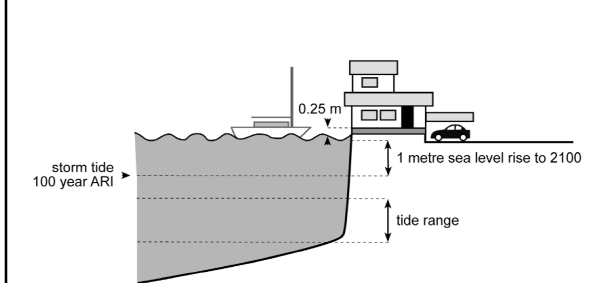
South



Source: Coast Protection Board (1992)

South Australian Policy related to sea-level rise

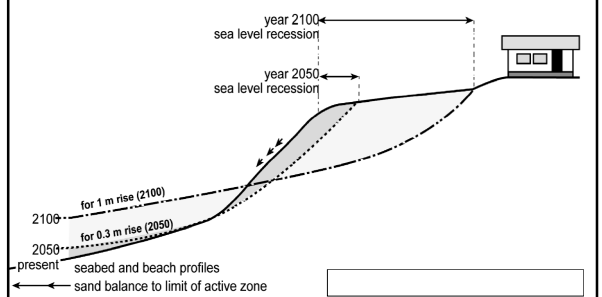
Building on or over the water's edge



Source: Coast Protection Board (1992)

South Australian Policy related to sea-level rise

Allowing for recession



Source: Coast Protection Board (1992)



### Conclusion: Australian coastal management and global change

- Move towards better integrated coastal management
  - Move towards more sustainable and strategic planning
  - Move toward 'best practice' coastal planning
  - Focus on dealing with the sea change phenomenon
  - Potential national coordination of coastal management
  - Recent national focus on coastal management and climate change
1. Last week's climate and coast report by Commonwealth Government
  2. A national coastal vulnerability strategy to be released in 2 weeks time
  3. A national coastal forum planned for early next year

