Sediment supply, seagrass interactions and remote sensing

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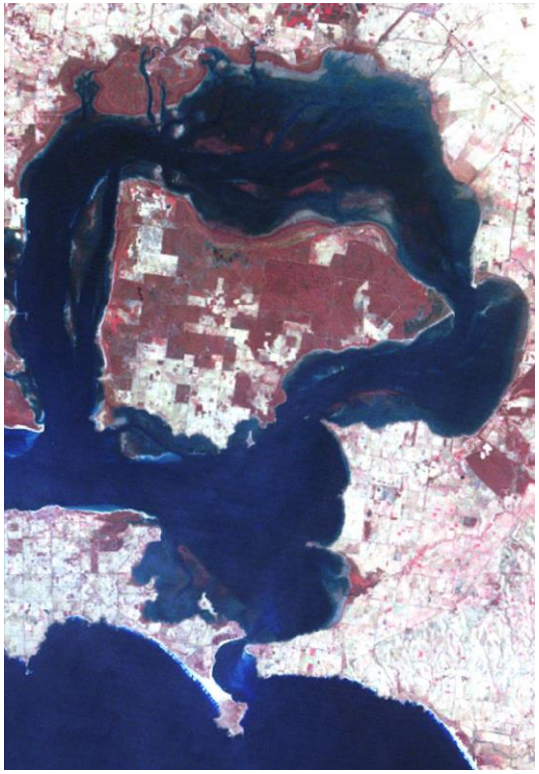
Rhys Coleman (Melbourne Water)

Sediment in Western Port

- Changed inputs
  - Catchment clearing
  - Agricultural intensification
  - River channelisation
  - Port dredging
  - Earthworks



19 January 1973

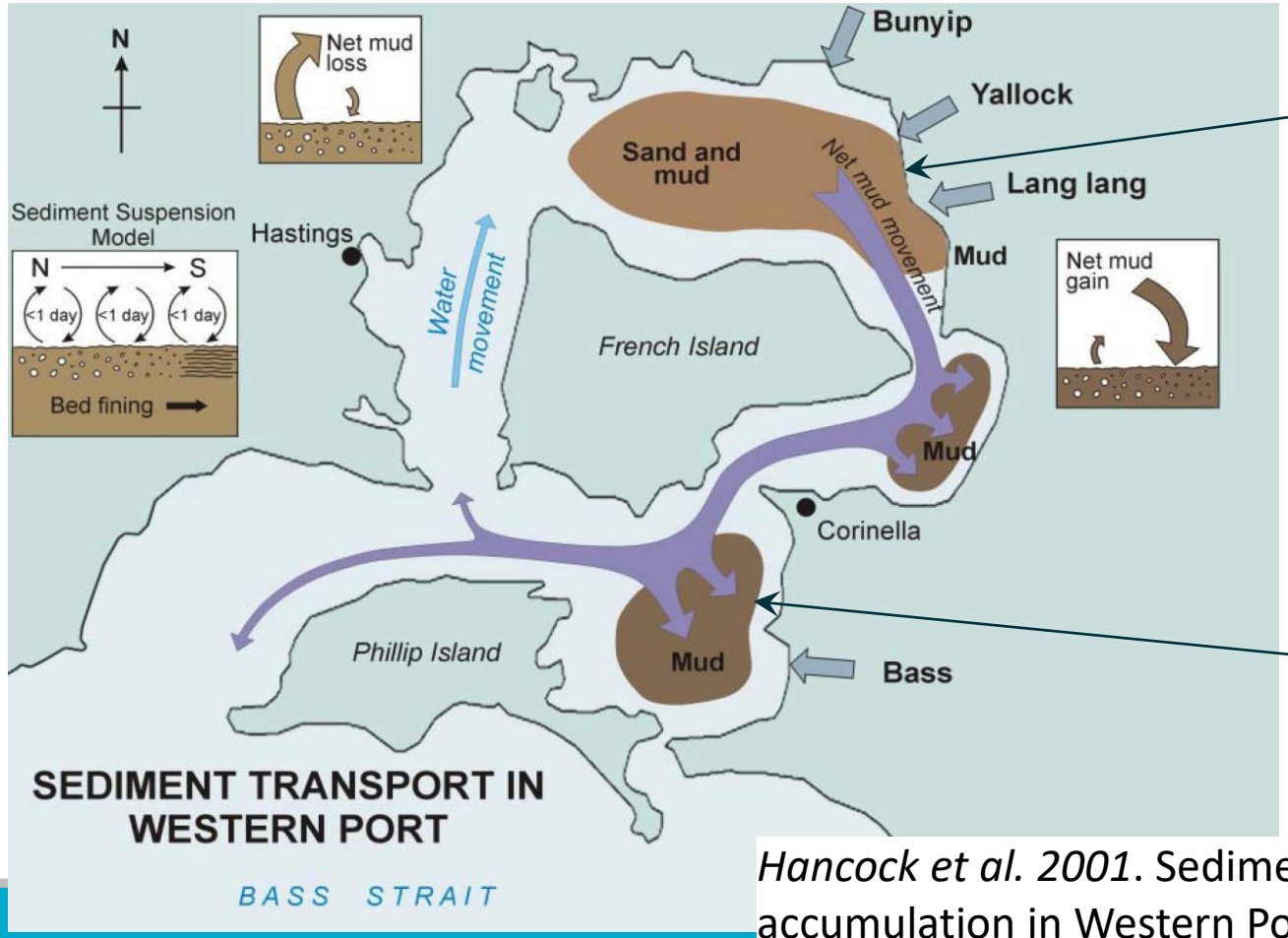
Landsat MSS

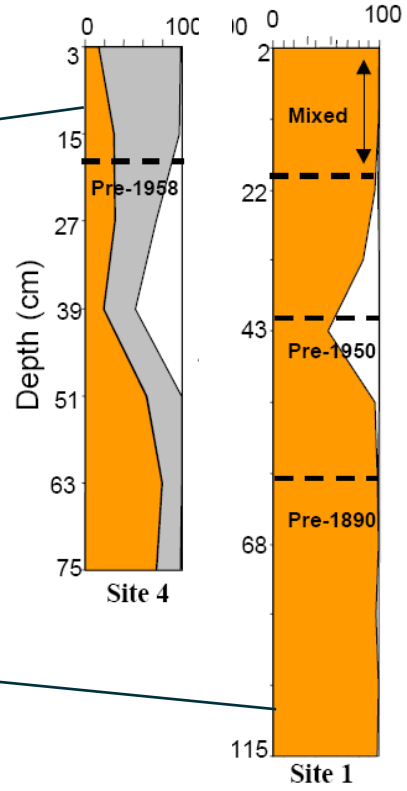
25 April 2016

Landsat 8

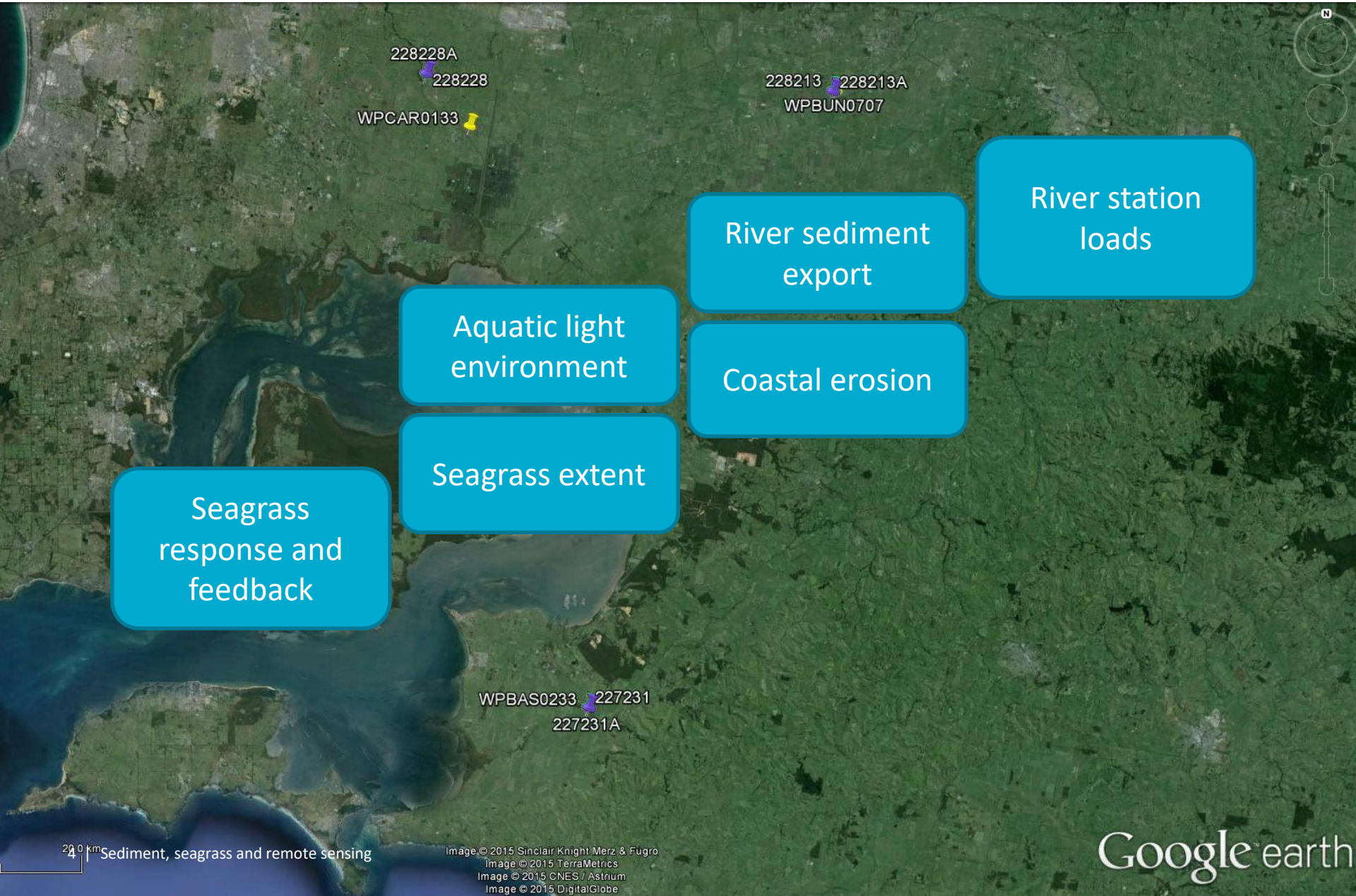
Sediment in Western Port

- Sediment deposition and transport





Hancock et al. 2001. Sediment transport and accumulation in Western Port. Technical Report 47/01. CSIRO Land and Water.


228228A
228228
WPCAR0133
228213
228213A
WPBUN0707
River station loads
River sediment export
Aquatic light environment
Coastal erosion
Seagrass extent
Seagrass response and feedback
WPBAS0233
227231
227231A
20.0 km
Image © 2015 Sinclair Knight Merz & Fugro
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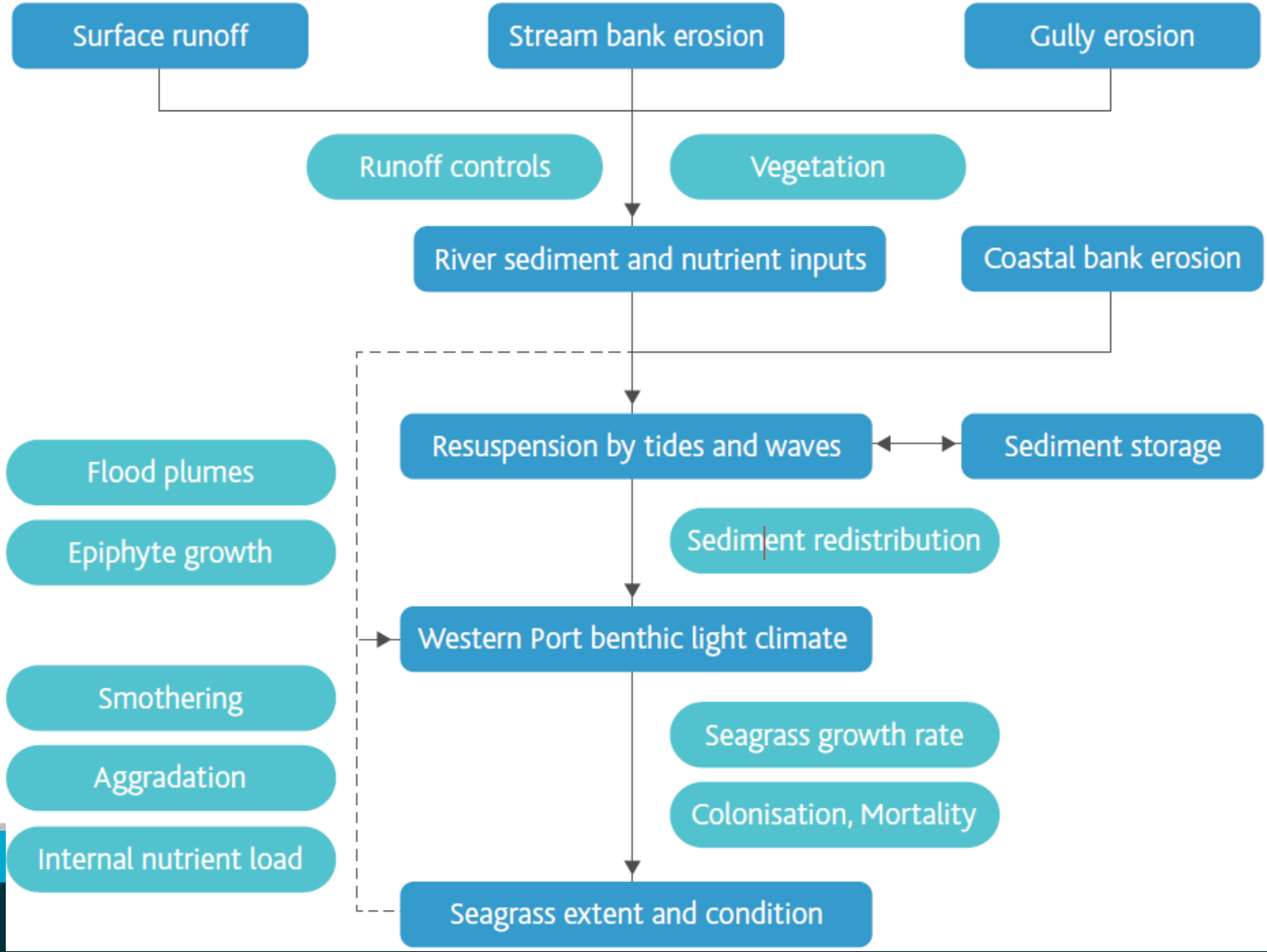
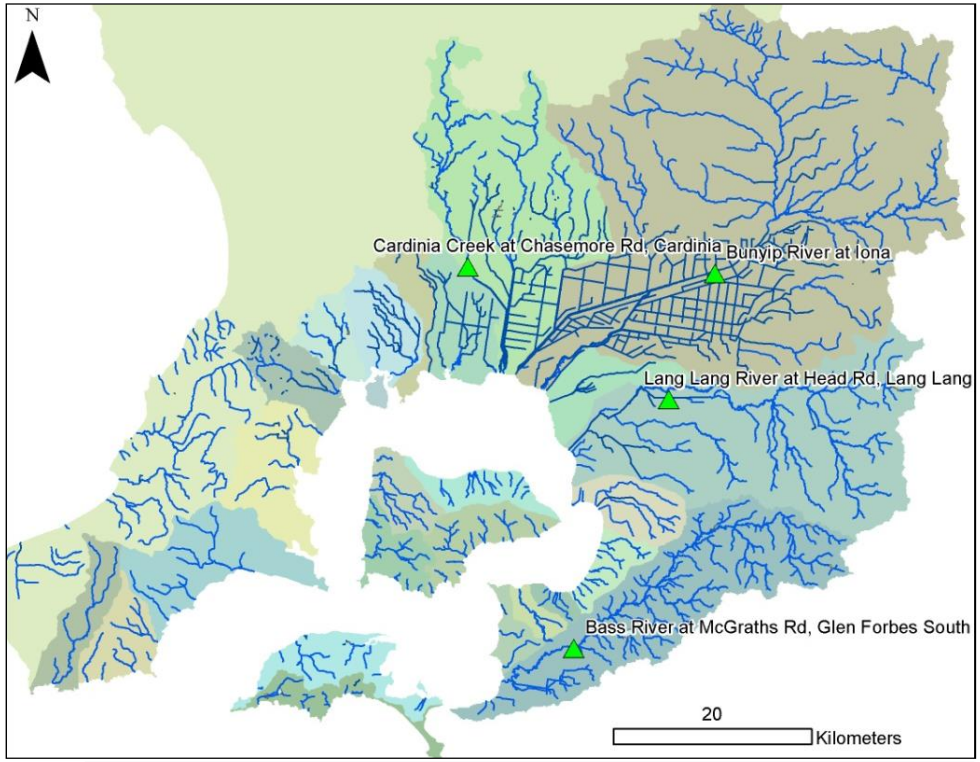
Google earth

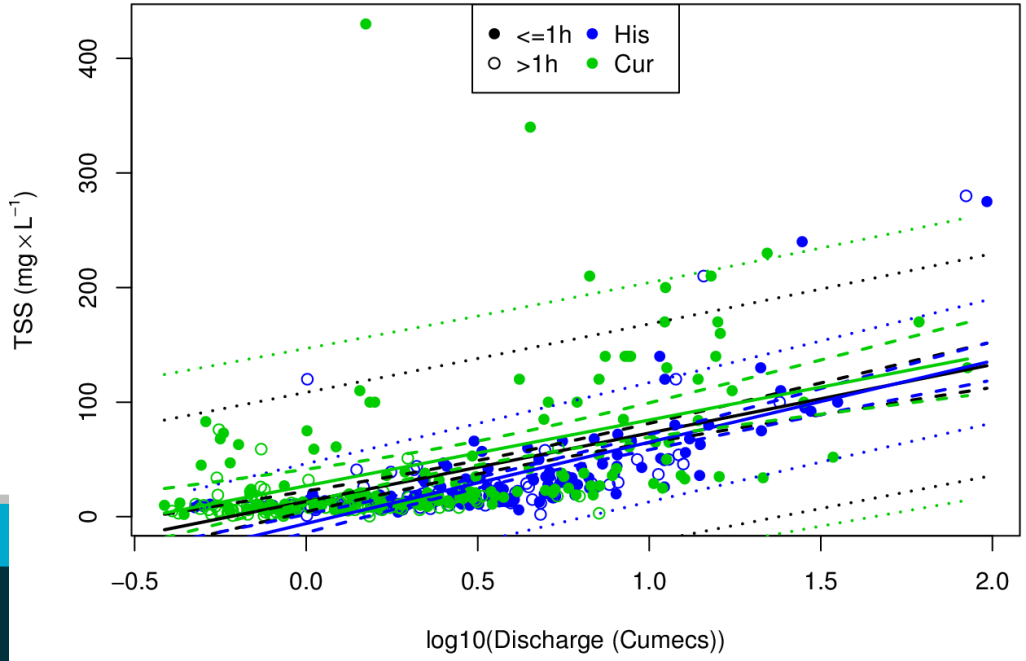
Linkages between sediment and seagrass



River gauge loads

- Some increase in concentrations since 1990s
  - Bunyip and Cardinia – Increased earthworks?
  - Bass - Agricultural intensity?
- Subsoil dominates sediment

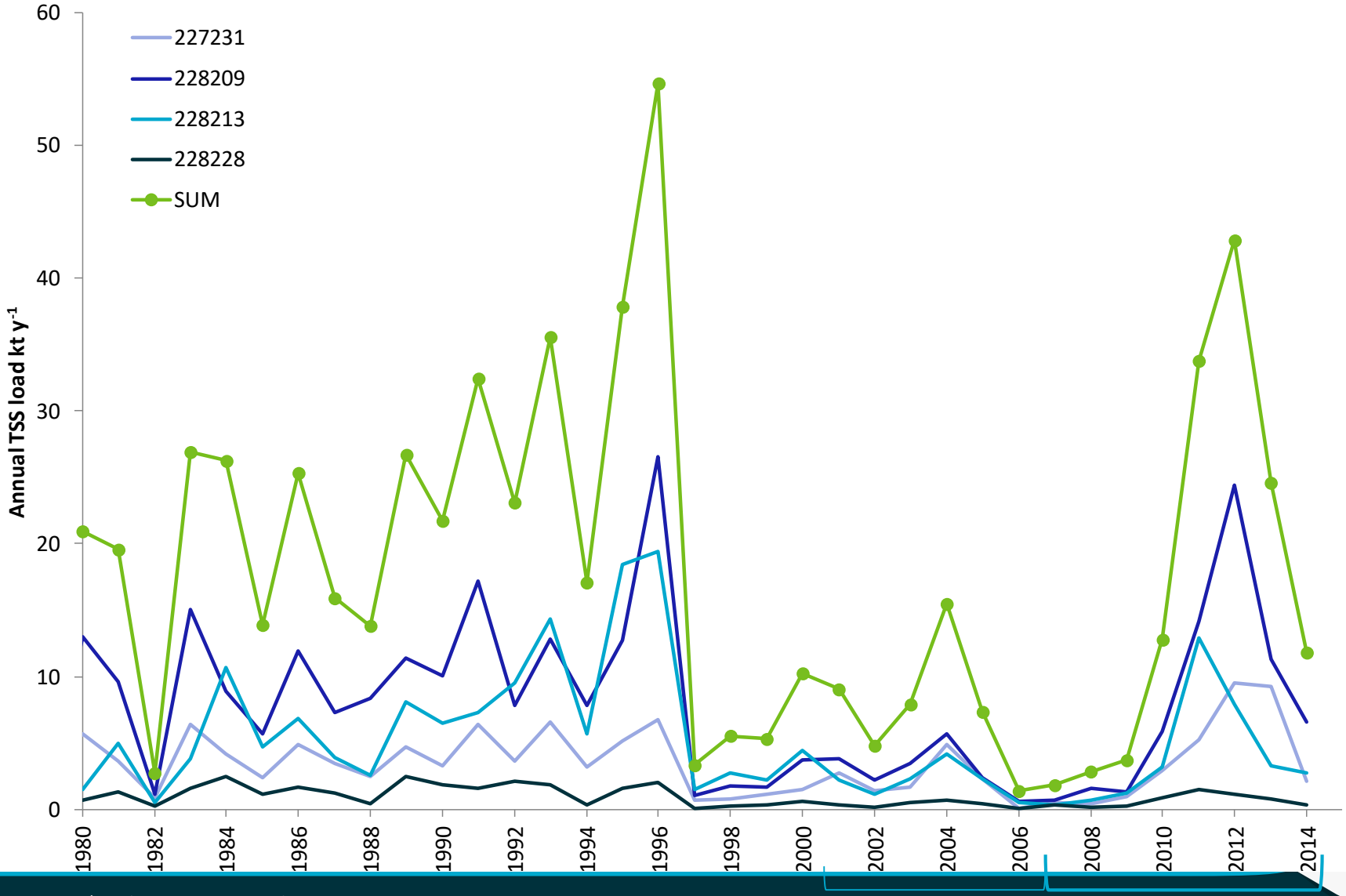




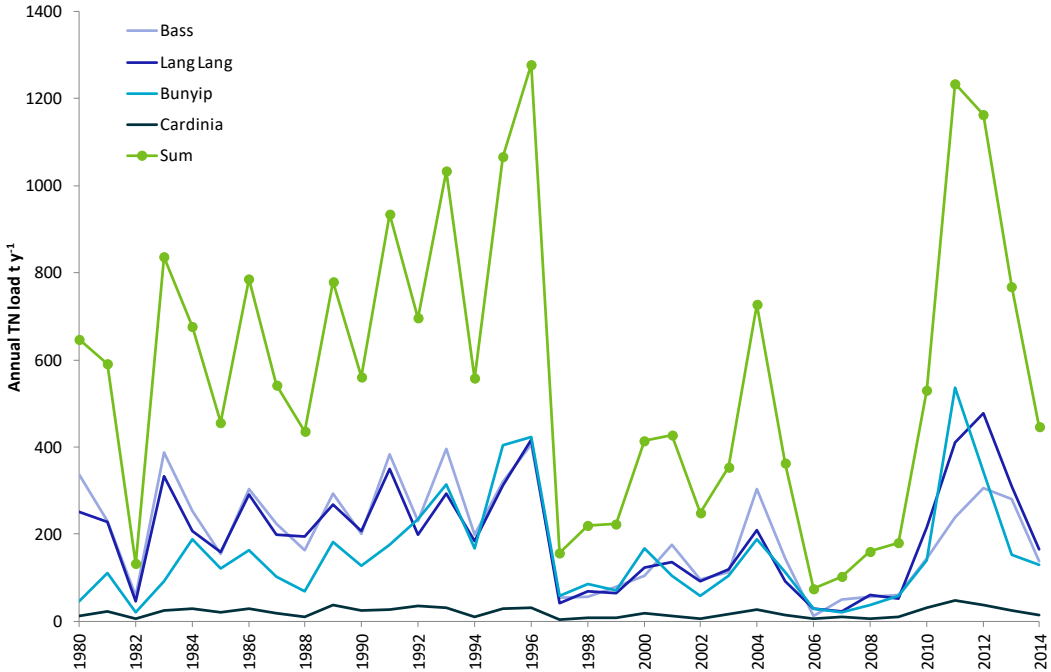
Inputs to Western Port scaled from gauge loads

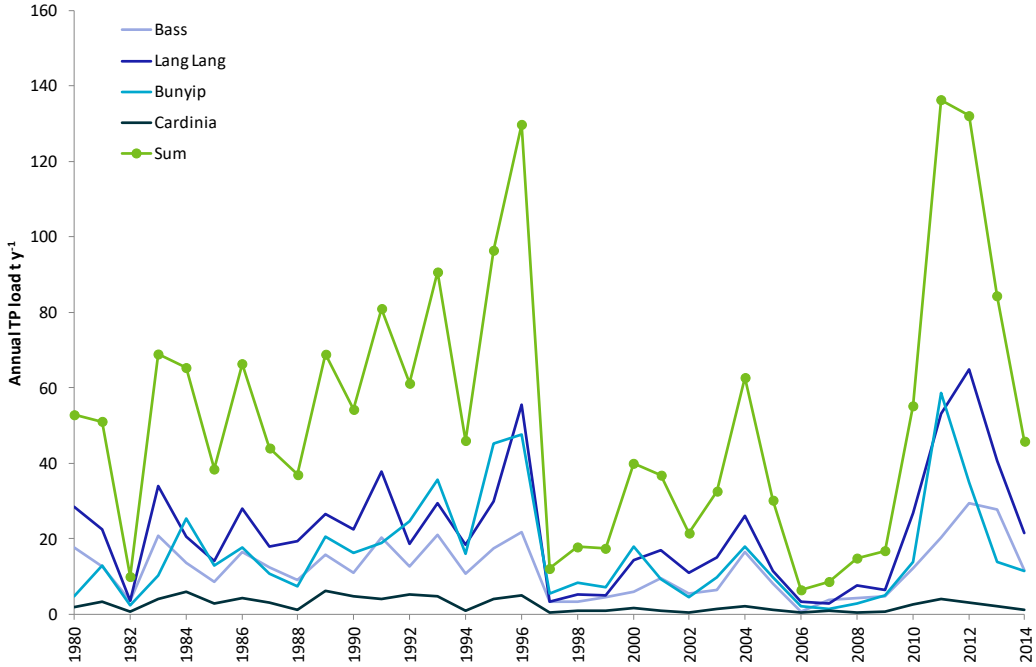
	CARDINIA	BUNYIP	LANG LANG	BASS	SUM
Estimated ratio export/gauge loads	3	1.4	1.22	1.11	**1.34**
Export TSS load (kt y^{-1})	2.8	7.4	9.7	3.9	**24**
Export TN load (kt y^{-1})	59	210	240	220	**730**
Export TP load (kt y^{-1})	7.5	23	27	13	**70**
Export TSS load (%)	12%	31%	41%	16%	100%

River station loads (TSS)

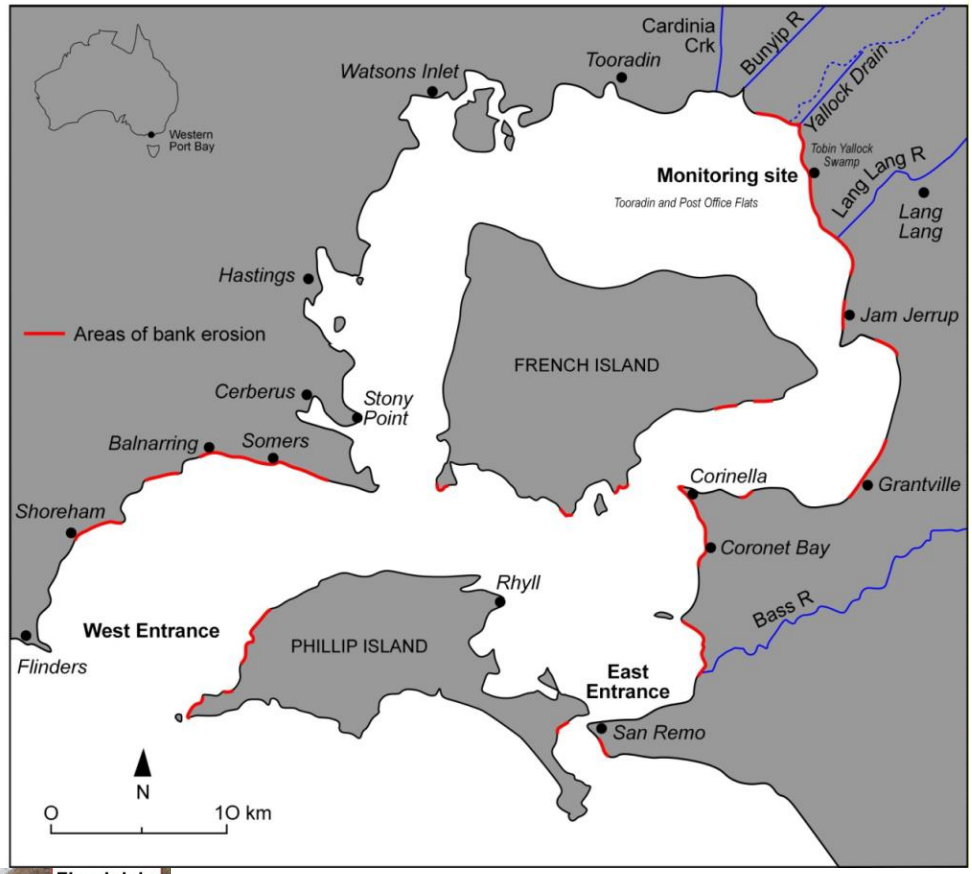


River station loads (TN and TP)





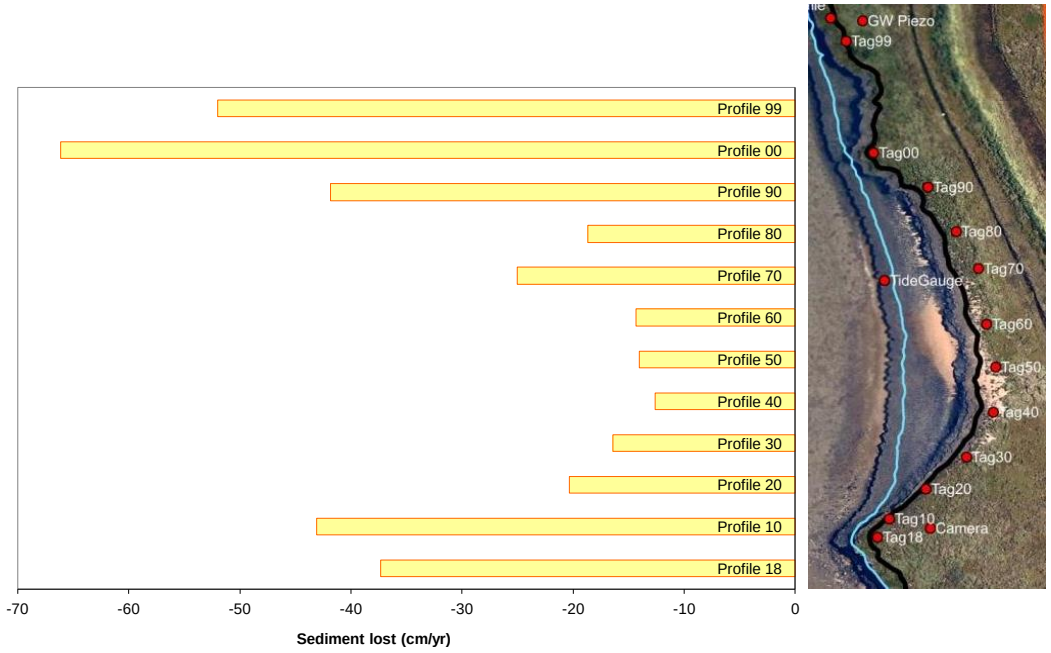
Coastal bank erosion

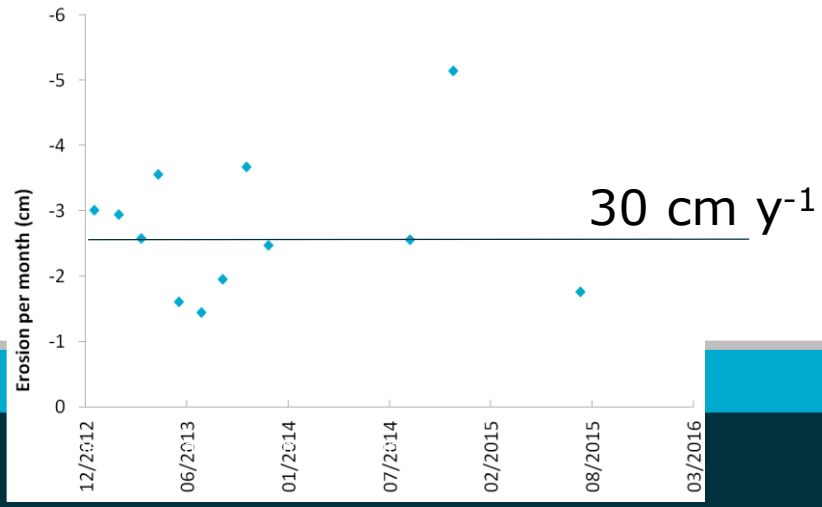


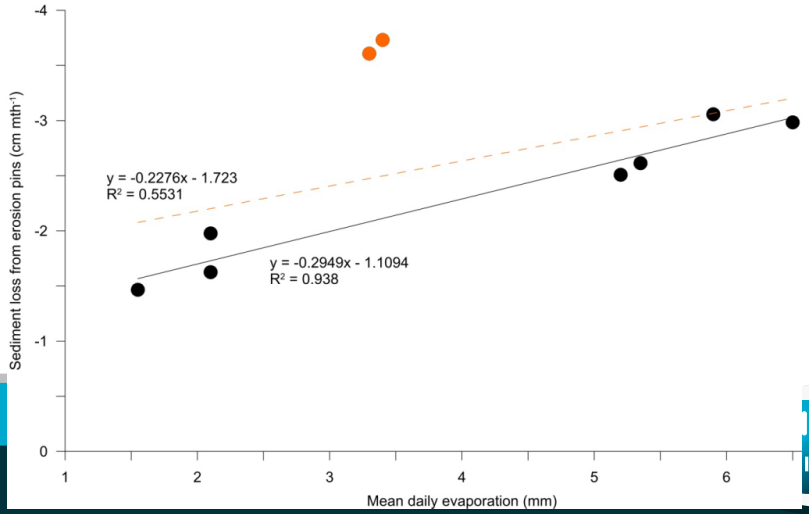
- Tomkins K, McLachlan G, Coleman R. 2014. Quantification of coastal bank erosion rates in Western Port. CSIRO.

Coastal bank erosion

- TSS input = 4-8 kt y^{-1}
- 76% clay

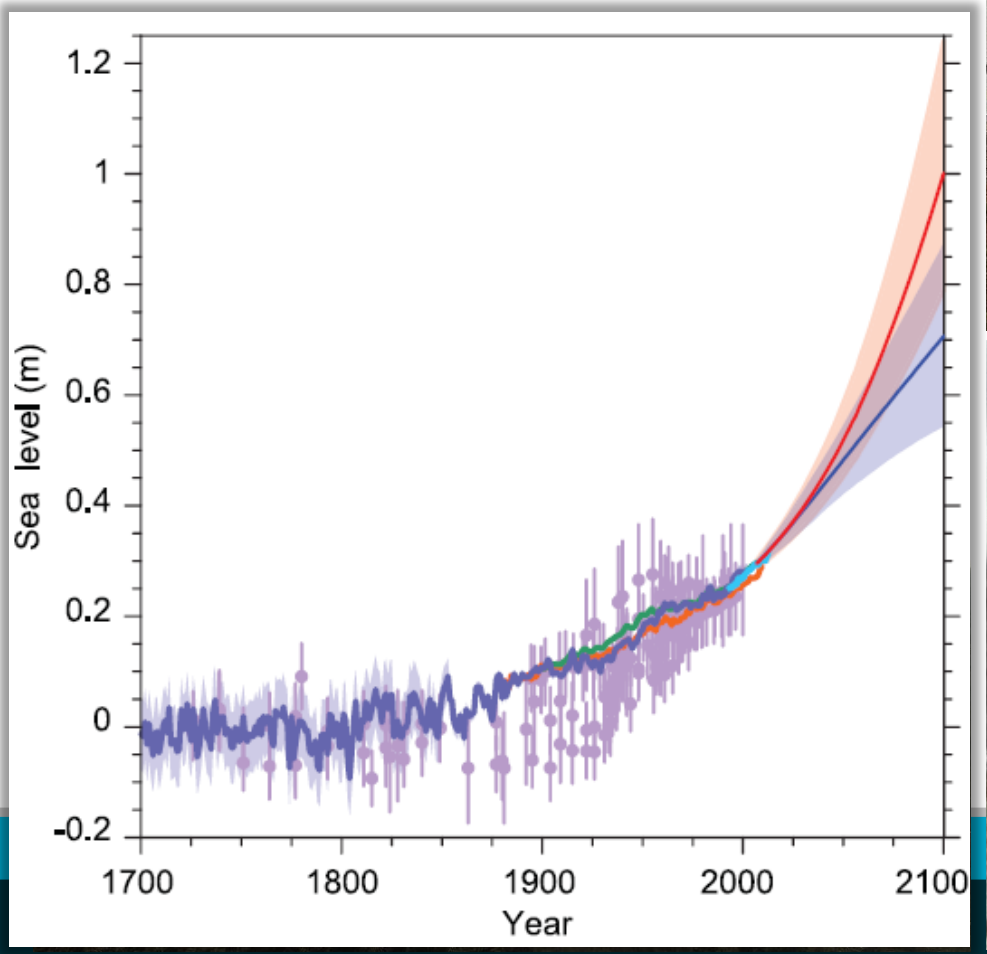




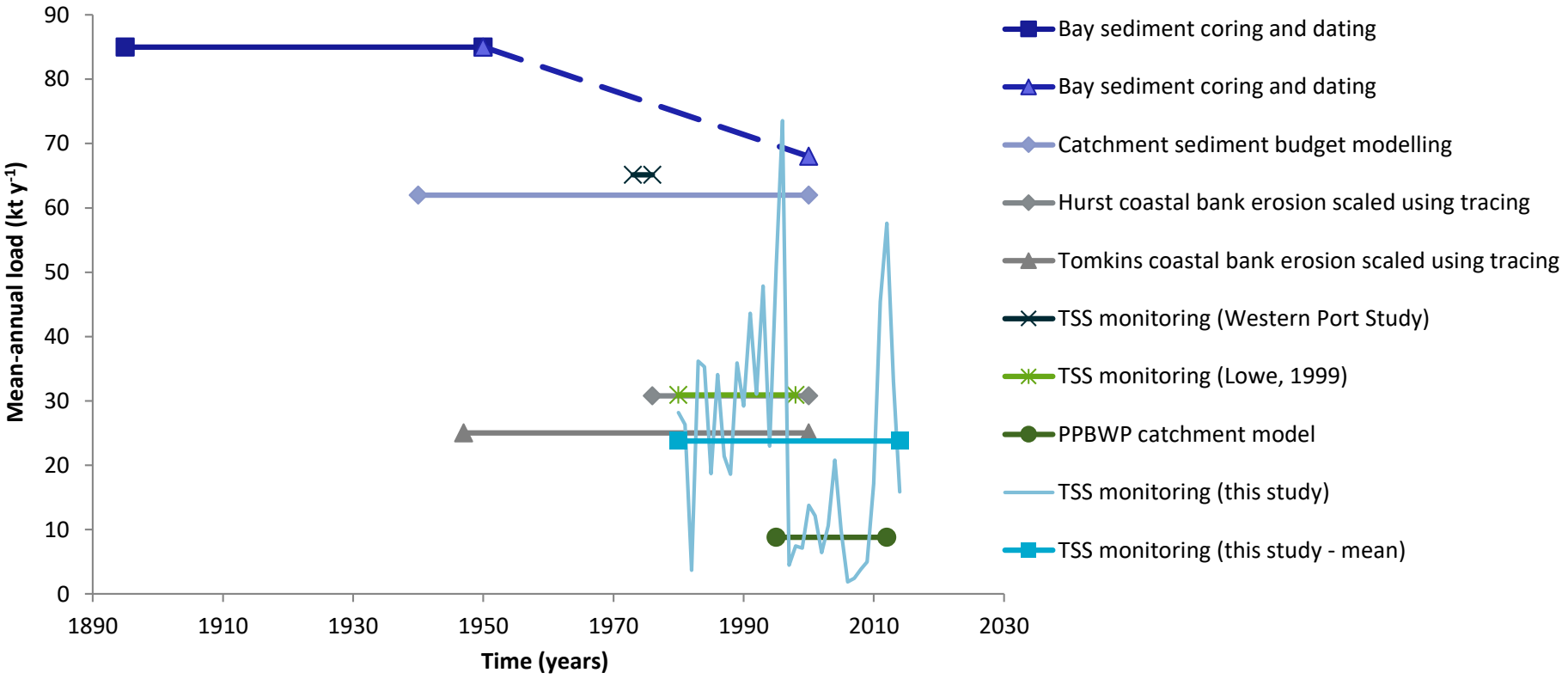


Coastal bank erosion

- 23-24-25 June 2014



Review of historical sediment inputs



Incised channels have stabilised

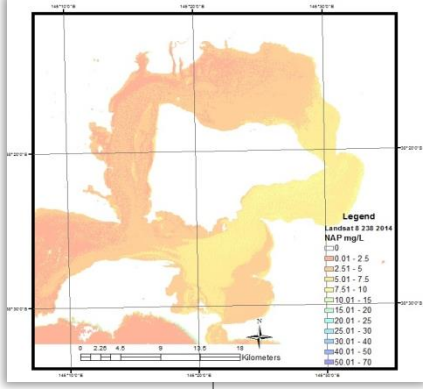
(a)

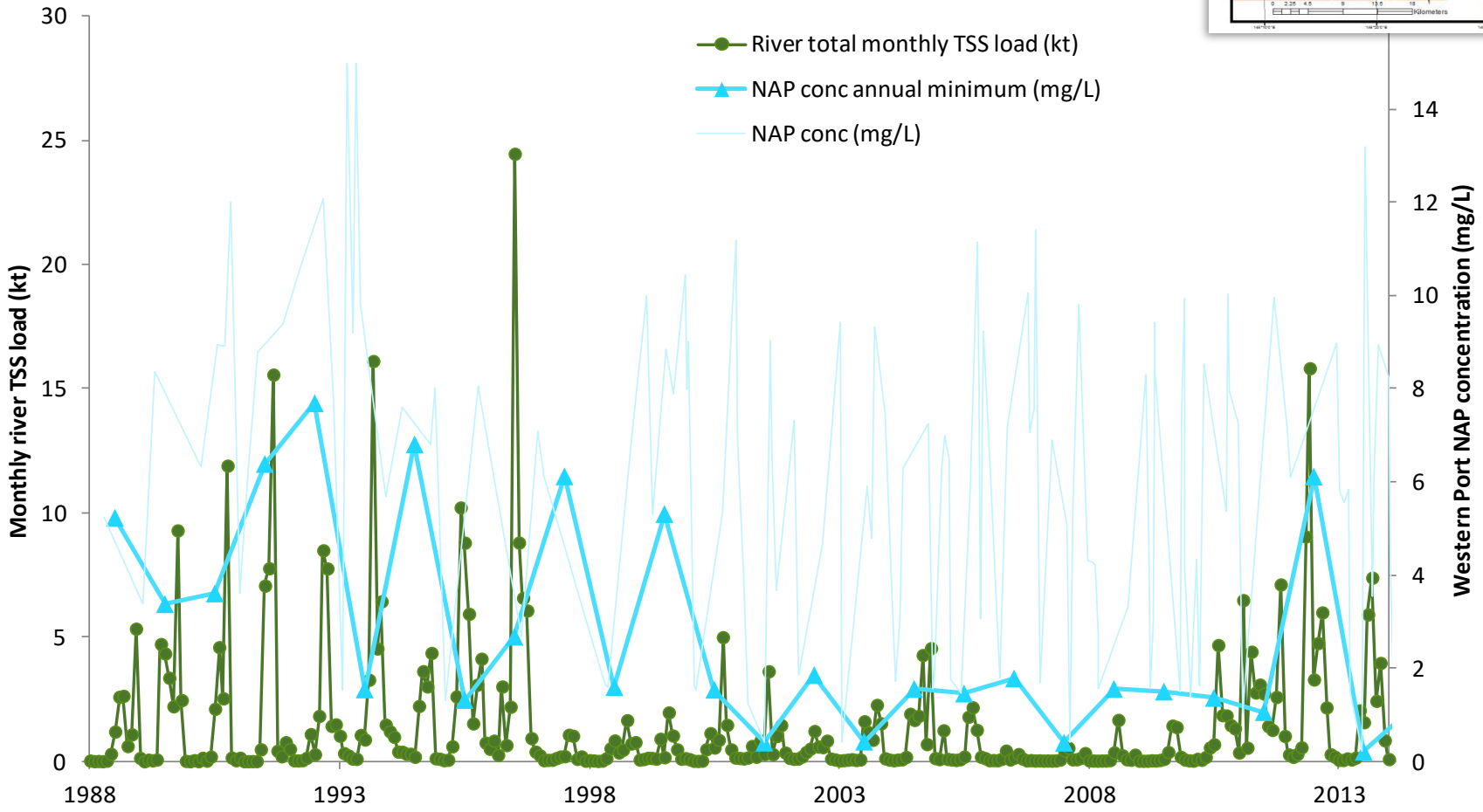
(b)

(c)

(d)

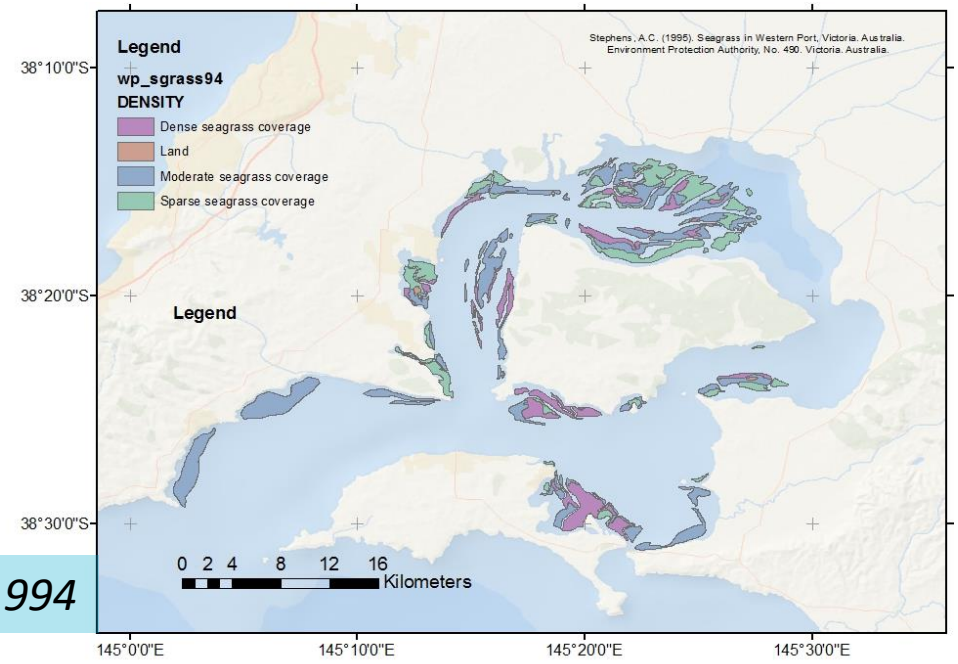
Western Port TSS concentration



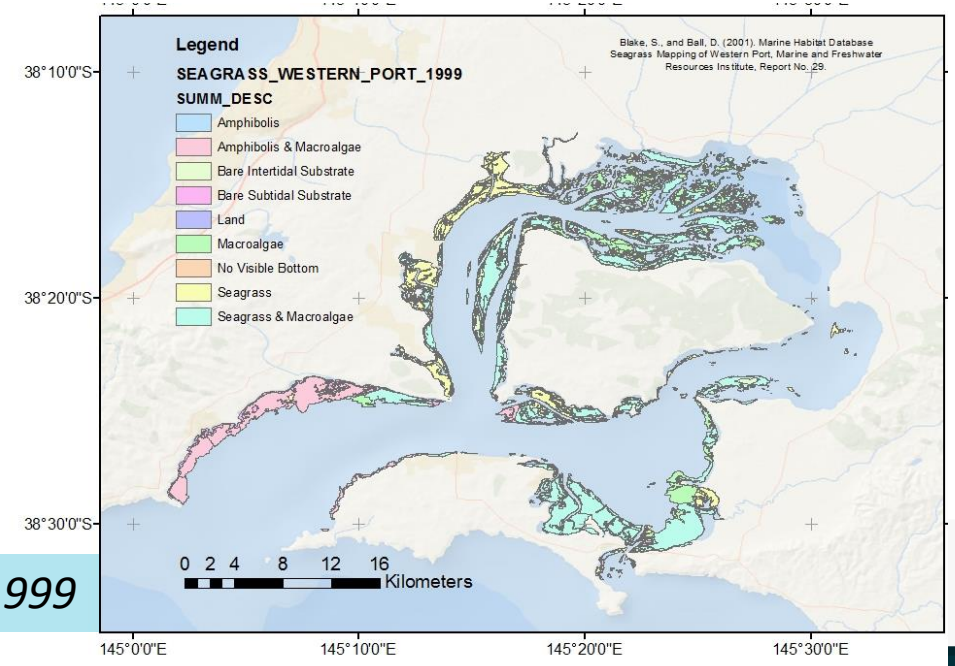


Seagrass extent

- 155 km^2 of seagrass and macroalgae were recorded:
  - 130 km^2 – seagrass or a mixture of seagrass and algae
  - 45 km^2 – mixed 'Dense Zostera/Heterozostera with algae'
  - 20km^2 – mixed 'Amphibolis with Macroalgae'
  - 25km^2 – 'Undefined Algae'



EPA 1994

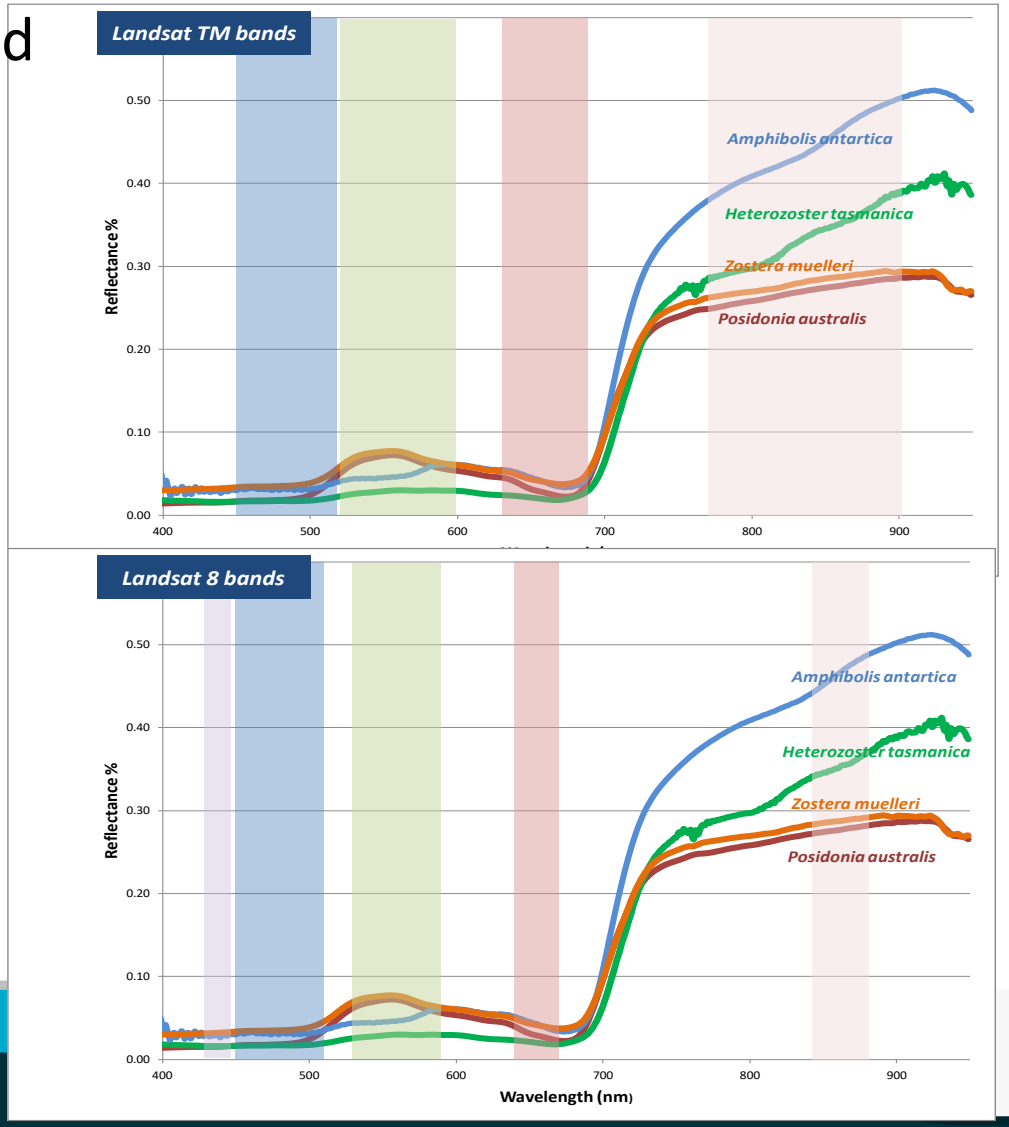


MAFRI 1999

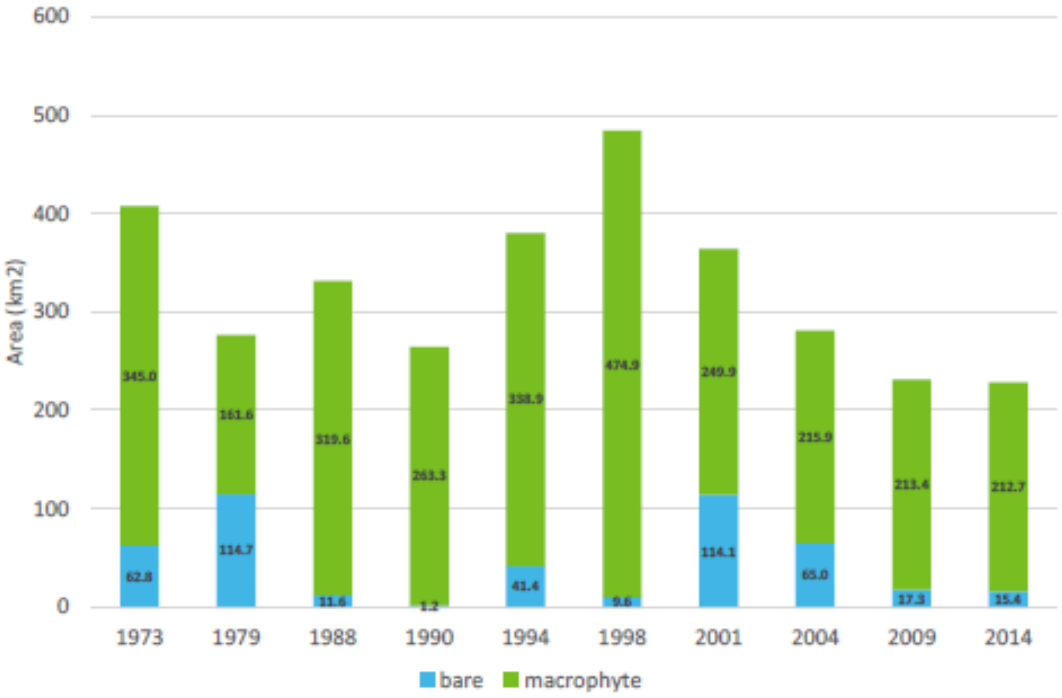
Blake, S. and Ball, D. (2001). Victorian Marine Habitat Database. Seagrass mapping of Western Port. Geospatial Systems Section, Marine and Freshwater Resources Institute report No. 29. Marine and Freshwater Resources Institute: Queenscliff

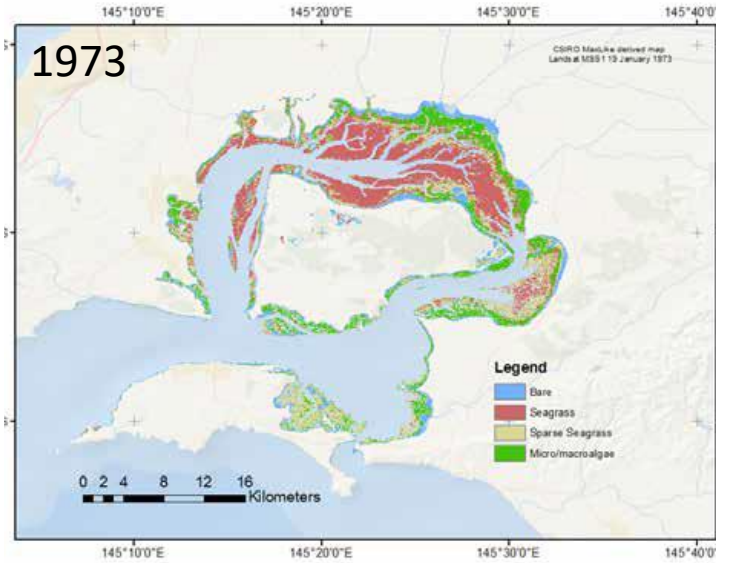
Landsat data for seagrass mapping

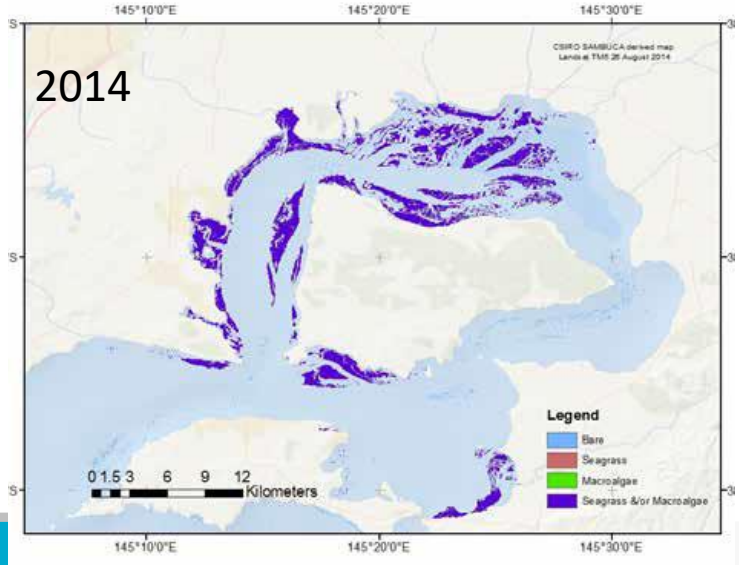
Spectra can discriminate algae and seagrass from mud



Seagrass remote sensing results

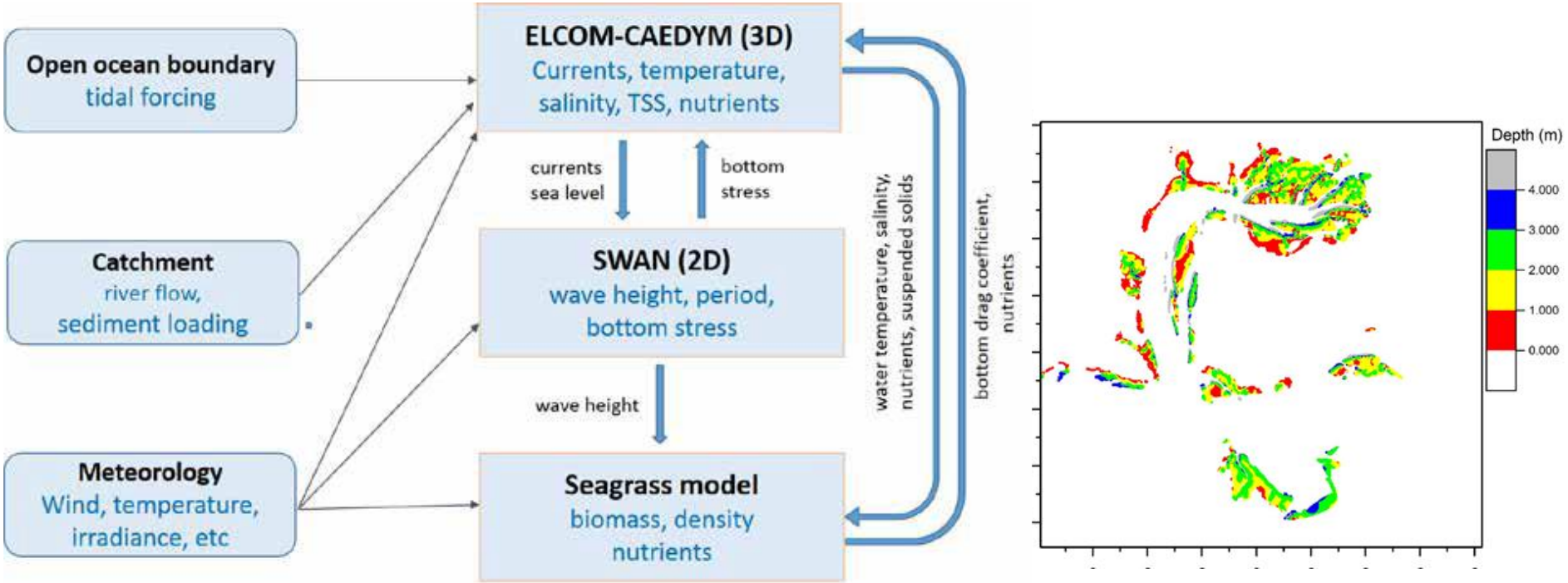






Seagrass response modelling

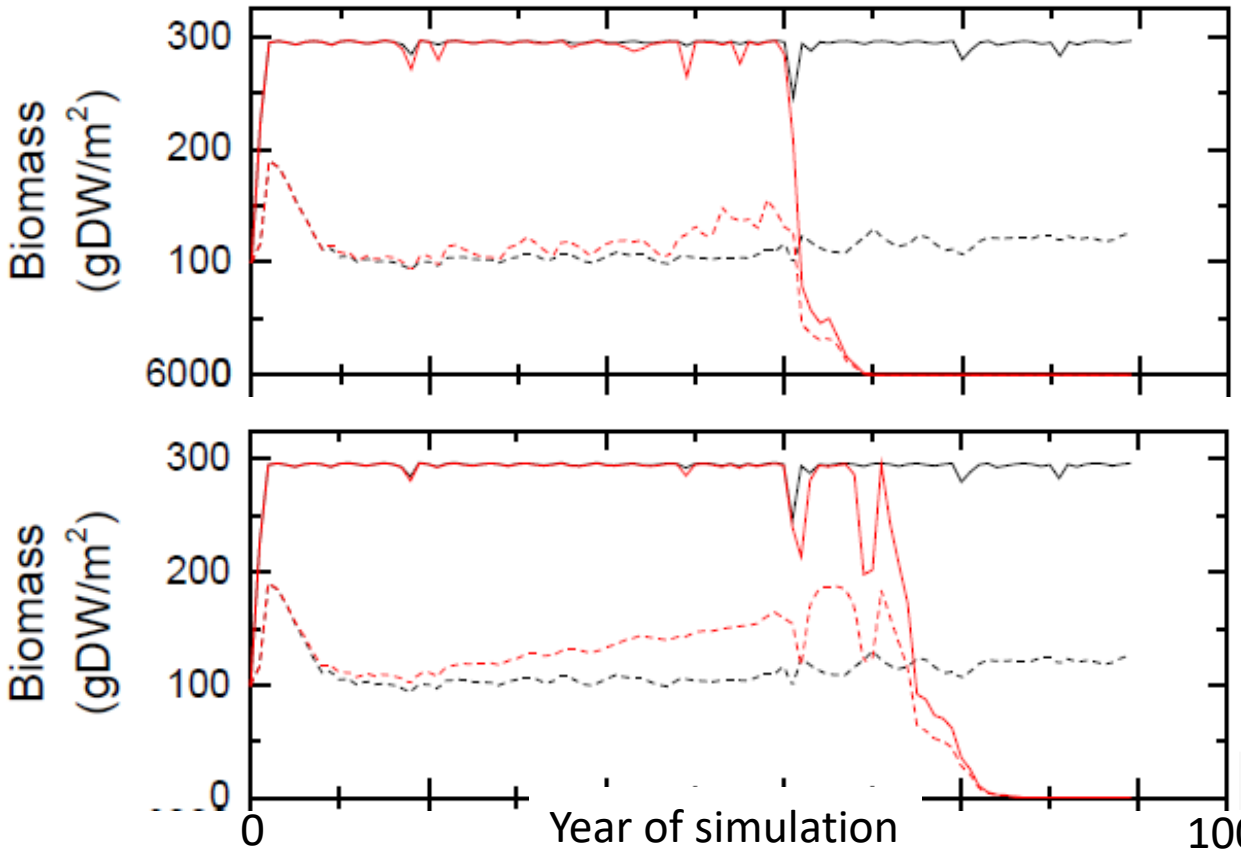
- Model inputs include light, temperature, salinity and nutrient limitation



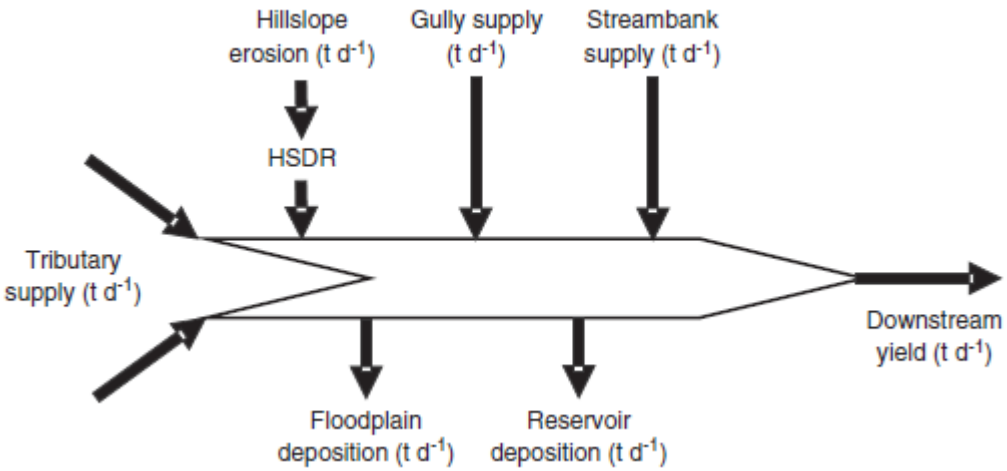
Sea level rise and temperature impacts

- Light climate affects seagrass condition and extent by modifying growth rate and mortality
- Sediment also impacts seagrass through smothering, and aggradation

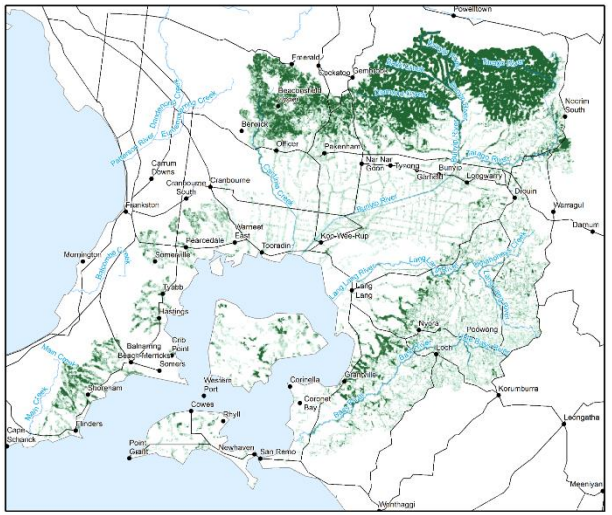
- 1 m sea level rise or 4 C temperature increase over 100 years reduces seagrass extent within existing range

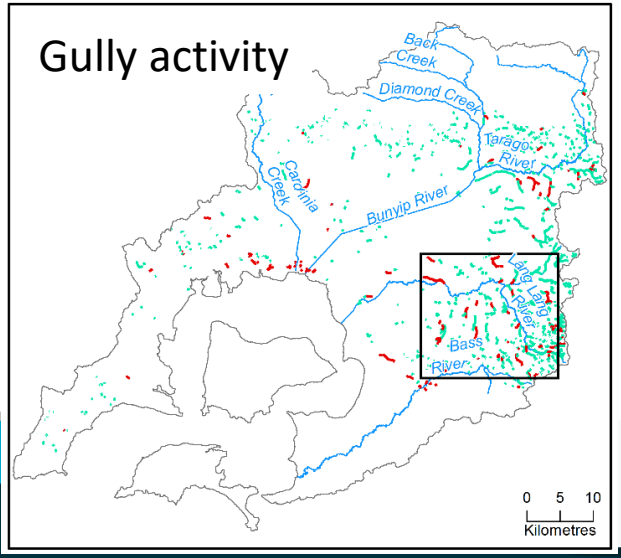


Catchment modelling of sediment sources



Riparian vegetation height





Summary

- Catchment sediment supply appears to be below a historical peak but is affected by landuse intensification and no longer declining
- Coastal bank erosion continues and may increase
- Bay turbidity can be affected by decadal variations in load
- Managing supply at or below current levels *may* help improve water clarity in coming decades
- Sea level rise and warming will reduce the seagrass extent within its existing range
- Remote sensing, river load monitoring and catchment modelling can help to inform and evaluate management, and assess condition