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The Response of a Coastal Lagoon to Freshwater Inflow – the Coorong

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Coorong and Lakes Alexandrina and Albert Ramsar site

- Ramsar-listed (1985) and Living Murray icon Site
- feeding and breeding grounds for birds including piscivores, herbivores, and waders



Flow over barrages



- Recent reduced flows a combination of climate and diversions
- Very high salinity in the South Lagoon has resulted in a degradation of its ecological condition
- Consequence of reduced barrage flows



Decline in herbivorous birds



Salinity tolerances (M. Geddes)

		SALINITY (%)							
	30	0	40	50	60	70	80	90	100
Hardyhead fish	Atherinosoma microstoma								
Inset larvae	Tanytarsus barbitarsis Ephydrella sp.								-
Molluscs	Hydrobia buccinoides Salinator fragilis Notospisula trigonella Arthritica semen								
Polychaetes	Ceratonereis pseudoerythraensis Nephtys australiensis Ficopomatus enigmaticus Capitella capitata	-							
Shrimp Salt-lake isopod Amphipods	Macrobrachium intermedium Haloniscus searlei Melita zeylanica Paracorophium spp. Megamphopus sp.					•			
Ciustaceans									

Hydrodynamic model

- Simulates
 - water levels
 - salinity
- In response to:
 - barrage discharges
 - degree of Mouth opening
 - sea level changes
 - Upper Southeast drainage inflow
 - wind
- Equations
 - momentum describes water movement
 - conservation of water
 - conservation of salt
- Purpose
 - to aid understanding of Coorong dynamics
 - to evaluate strategies for managing the Coorong

Salinity comparison – N & S Lagoons



Long term salinity variations – South Lagoon





The role of barrage flows



- barrage flows:
 - lower the salinity at the northern end of the Coorong
 - push water back and forth between the lagoons and
 - open the Mouth and let water level oscillations from the sea penetrate into the Coorong





Mouth dredging



- open Mouth increases mixing between ocean and Coorong and along Coorong
- diminishing benefit for dredging below – 2m

 normally barrage flows maintain Mouth opening

Discharge (m

• during no flow, dredging implemented to open Mouth





Ecosystem Response Model

- based on classification of Coorong into set of states based on environmental and biological attributes
- data from 9 years collected at 12 sites along both lagoons
- method based on classification and regression tree (CART) analysis
- environmental attributes include
 - salinity
 - water levels (seasonal and fluctuating)
 - water quality (nutrients and turbidity)
 - meteorology
- biological attributes include
 - bird numbers and species
 - fish numbers and species
 - macrophytes
 - invertebrates
- analysis derives 8 ecosystem states 4 in each lagoon



Ecosystem states for MDBA scenario 10349000



Year

Ecosystem states over 114 years





ERM System States



Unhealthy Hypersaline State – an example

environmental attributes

- high average salinities
- low average water levels
- low variability in water levels
- high number of days since barrage flow
- water quality had high average nutrient concentrations (e.g. ammonia and total phosphate) and high turbidity.
- biological attributes
 - low numbers of fish (except high numbers of hardyhead)
 - low fish diversity
 - low abundances of some piscivorous bird species
 - very small diversity of invertebrates
 - but still high numbers of chironomid larvae