



Photo: Tony Roach

Anthropogenic modification in estuaries: the challenge of choosing indicators of impacts

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Anthropogenic modification in estuaries

- Most of the world's population live close to the coast
- We rely on estuarine and coastal ecosystems for essential services
- Anthropogenic activities contribute to contamination
- Habitat modification also widespread



Anthropogenic modification in estuaries

- Ecological communities living in estuaries exposed to multiple stressors
- Monitoring to understand impacts and investigate opportunities to reduce impacts



Assessing impacts in Australian estuaries

- No national system for assessing ecological status of Australian estuaries
- Lack taxonomic knowledge of Australian flora and fauna

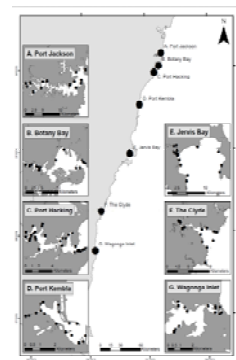


Designing baseline studies

- To optimize estuarine monitoring programs in Australia we need:
 - to identify sensitive ecosystem components
 - to implement relevant monitoring tools
- Quantify changes in the ecology of estuaries related to:
 - reductions in pollutants and environmental stresses
 - improvements in management of these environments

Baseline surveys in NSW estuaries


- Comparisons made against appropriate reference areas (other estuaries)
- Replication at multiple spatial scales



Delineating Zones

Physical conditions:

- Wave exposure
- Grain size
- Oceanic flushing
- Tidal influence



Monitoring Tools

- Benthic sediments
- Suspended sediments
- Transplanted oysters
- Water quality probe




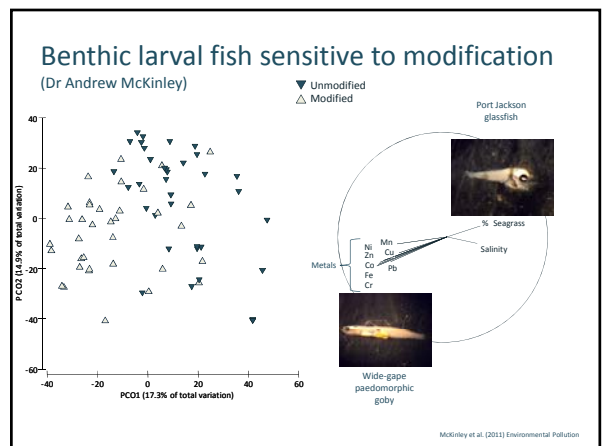
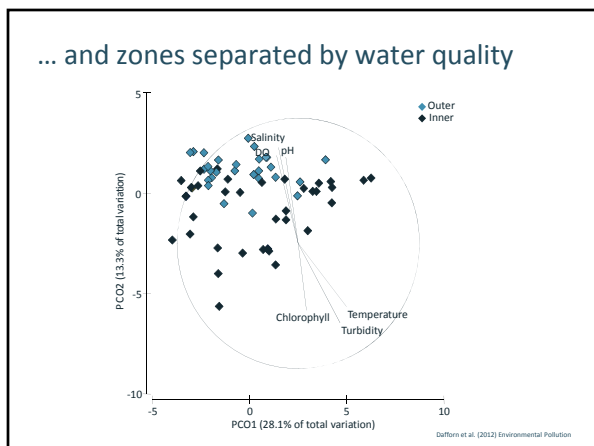
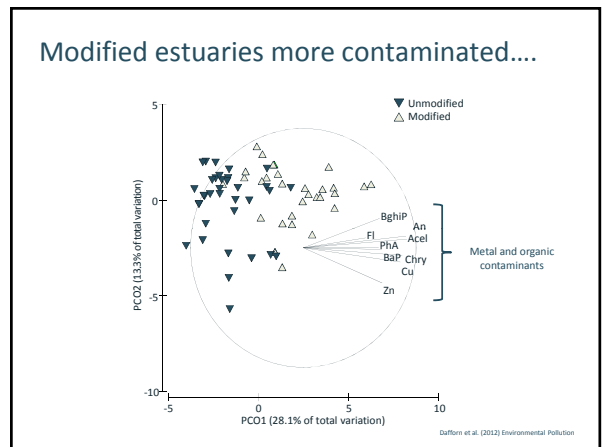
Ecological Indicators

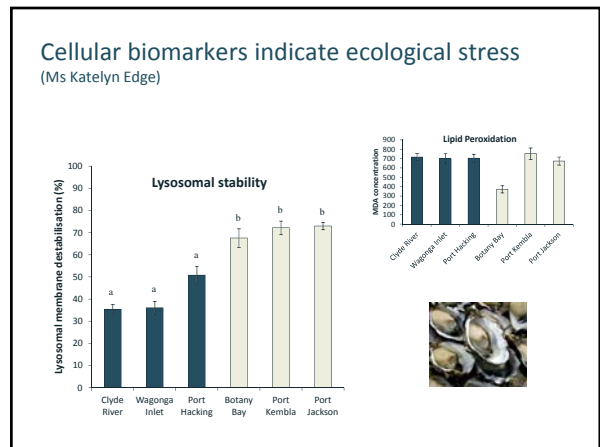
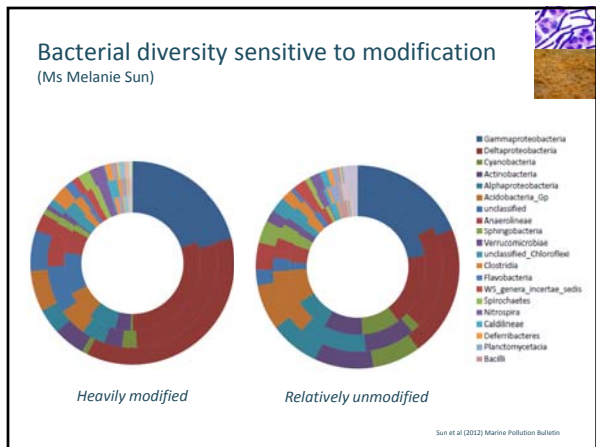
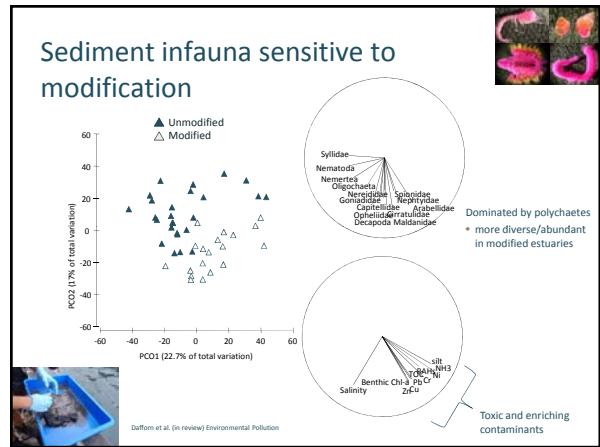
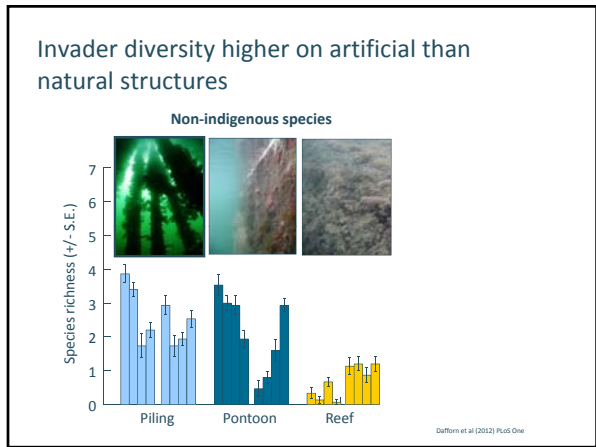
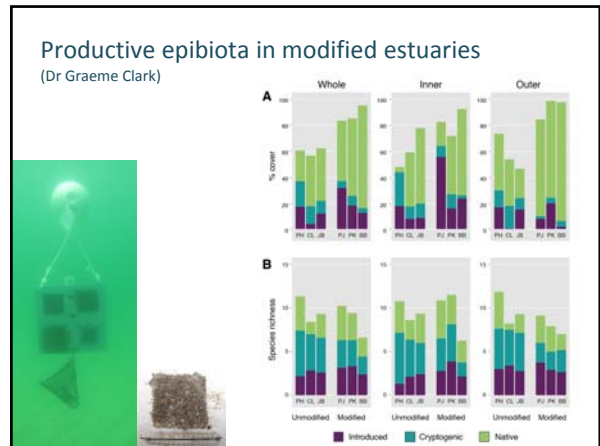
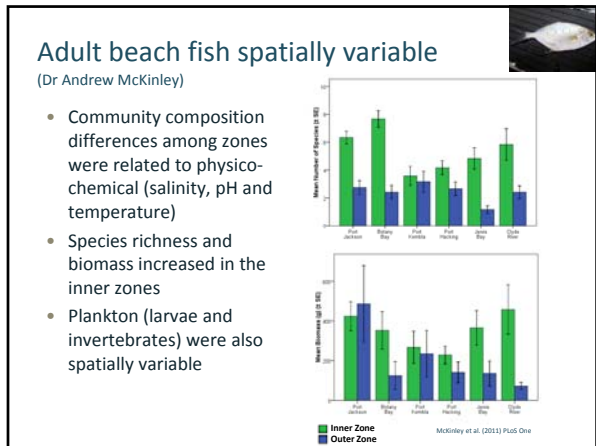
- Fishes
- Epibiota
- Infauna
- Bacteria
- Biomarkers



Contaminant monitoring tools

- Benthic sediments analysed from grabs
- Oysters deployed in a bioaccumulation study (time integrated measure)
- Suspended sediments collected in traps (time integrated measure)
- Water quality measured with a probe



Report card for Sydney Harbour

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Benthic larval fish
 - Abundant and diverse assemblages
 - Wide-gape paedomorphic goby 60-95% of the assemblage
- 
Benthic and pelagic adult fish
 - Highest biomass
 - Most diverse and abundant in inner zones
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Plankton (larval fish and invertebrates)
 - Spatially variable
- 
Epiibiota
 - Increased productivity
 - Exotic species associated with artificial structures
- 
Infauna
 - Abundant and diverse polychaete assemblages
 - Polychaete worms >60% of the assemblage
- 
Bacteria
 - Reduced diversity related to contamination

Sensitive ecological indicators?

Measure	Sensitivity	Caveats
Adult beach fish	☀️	Not sensitive
Benthic larval fish	☺️	Highly relevant but time-consuming to census and requires taxonomic expertise
Plankton	☀️	Highly variable and not overly sensitive
Epiibiota	☺️☀️	Not as highly exposed to sediment contamination but relevant to water column impacts
Infauna	☺️	Highly relevant but time-consuming to census
Bacteria	☺️	Costs decreasing rapidly but ecological relevance needs further investigation
Biomarkers	☺️	Lysosomal membrane destabilisation sensitive but ecological relevance needs further investigation.

Future research directions

- Manipulative experiments to investigate major drivers
 - toxic contamination vs. nutrient enrichment?
- Ecological engineering to reduce impacts of artificial structures
 - beyond seawalls




Photo: Melanie Sun





Photo: sydney.edu.au

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Sydney Harbour Research Program

