

NSW MER Strategy: Indicators for Assessing Ecological Condition of Estuaries in NSW

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10 Commandments for Monitoring

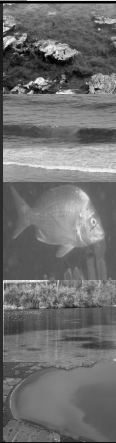
1. *Thou shalt know why you are monitoring*
2. *Thou shalt not make water quality an idol*
3. *Thou shalt know what pressure and stressors are relevant to your system*
4. *Thou shalt know how your system is likely to respond and keep it holy*
5. *Honour the match between the indicators and the pressures*
6. *Thou shalt not murder the experimental design*
7. *Thou shalt not commit adultery of the samples*
8. *Thou shalt not steal others ideas (without testing)*
9. *Thou shalt not bear false witness about the causes of your problems*
10. *Thou shalt not covet thy neighbour's (or grandfather's) indicators (or their ass!)*

National Water Quality Management Strategy

Framework for addressing a wide range of
issues associated with water monitoring.

NWQMS advocates use of biological indicators
for ecological health

NOT just the WQ look-up Table



Pressures, Stressors and Outcomes

- **Pressure**
 - Landuse, entrance change, water extraction, riparian clearing, water extraction, population density
- **Stressors**
 - Pollutant (including nutrient) loads, tidal prism, river flow, salinity, altered trophic structure, turbidity, physical damage/disturbance, carbon flow



POSSIBLE LEVELS OF MEASUREMENT

Pressures Stressors Outcomes

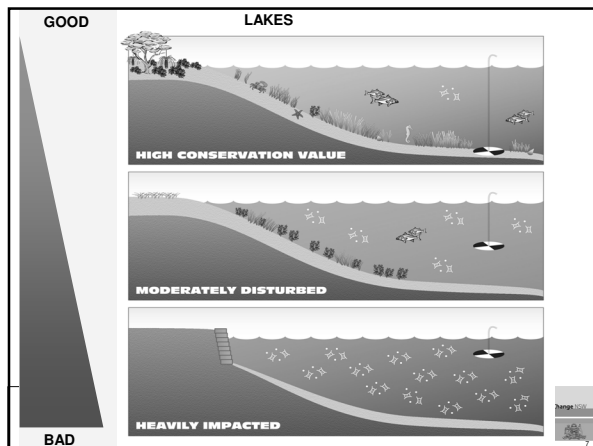


Confidence of Depiction of Condition

Conceptualisation is Really Important

- **Qualitatively links pressures – stressors - outcomes**
- **Focuses attention on appropriate indicators according to relevant pressures**
- **Facilitates management feedback**





Indicator Selection- Underlying principles

- Separate drivers, stressors and outcomes
- Indicator response should be well understood and predictable
- Referential system – need reference condition
- Should be able to make a link between indicator value and pressure status

Current MER Indicators of Estuarine Condition

- Algal abundance – micro and macro
- Fish assemblages (using methods of Harrison and Whitfield 2004)
- Macrophyte abundance
- Supported by
 - Water Clarity (turbidity, secchi)
 - Salinity
- Ideas in Development for Process measurements
 - Derived primary production
 - Trophic status (sediments)
- Pressure Indicators are also reported

How did we get to this list ?

and

Why no water quality indicators?

Lets Look at “Water Quality” as an ecological condition indicator

- A long-time favourite, reinforced by cursory and lazy application of the ANZECC National Water Quality Management Strategy
- Essentially “STRESSOR” monitoring
- Rarely tells us what we really want to know
- Blindly applied in many inappropriate circumstances because alternatives are unknown or not-trusted (e.g. estuaries)
- Indicator behaviour rarely (never) tested – what are the stressors responding too?
- Links to outcomes tenuous at best

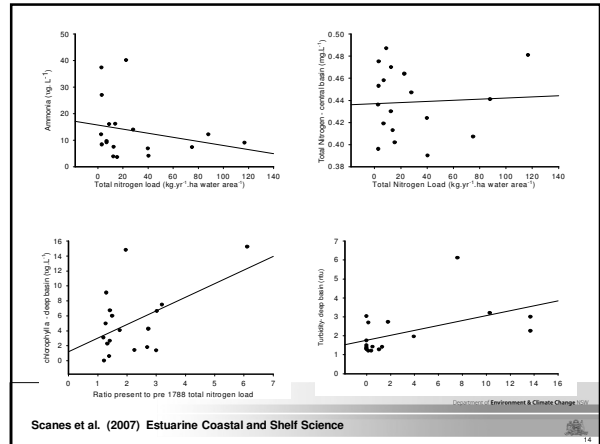
So, why do we keep measuring stressors?

- “Easy” – maybe from a collection perspective (though real problems here are often overlooked) but interpretation is very difficult and dependant on many factors, spatial and temporal resolution of sampling, response times, external modifiers etc
- “History” – this is a real cop-out, our grandfathers did it so we should too? “We already have a long data set”. Why persist with something that is telling us nothing?

For example,

ESTUARINE WATER QUALITY (NUTRIENT CONCENTRATIONS) AS A CONDITION INDICATOR

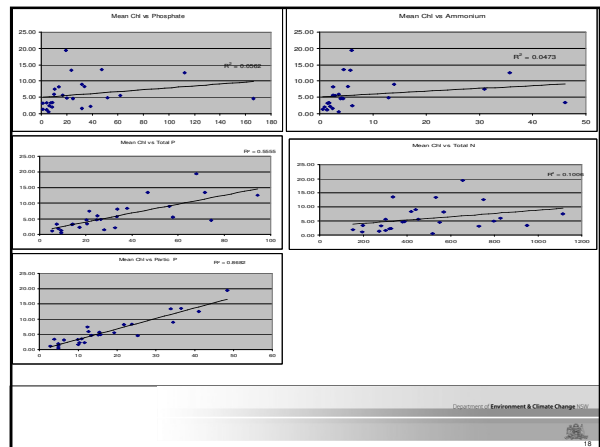
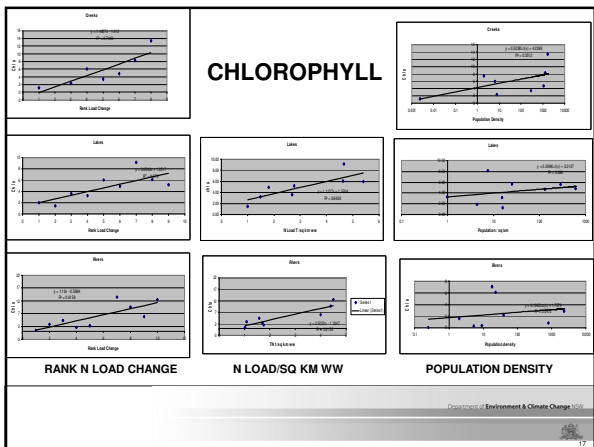
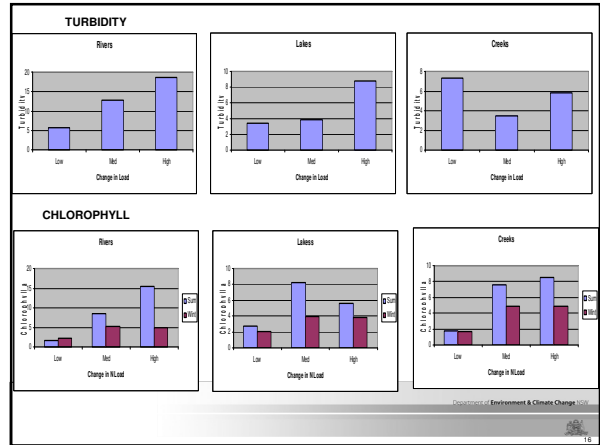
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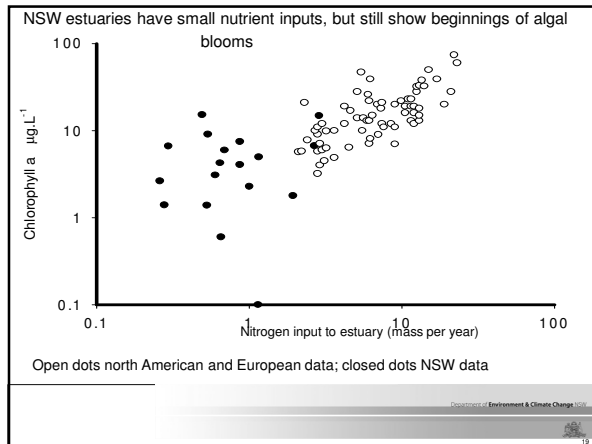


MER PILOT STUDY

- 28 randomly selected estuaries (rivers, creeks, lakes) stratified into low, medium and high catchment disturbance
- 2/4 sites/estuary, 3 replicates per site, 8 times per year
- Chlorophyll, turbidity, usual WQ

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Where is the MER going now?

- Pilot sampling all over coast, but Pilot Report was HCR CMA
- This year, SR CMA
- Next year, NR CMA
- Design (water)
 - 7 estuaries every year; 6 sampling times in summer/dry each year
 - Each year 20 – 24 random estuaries per CMA
 - Chlorophyll by fluorometry, others by probe
 - Transects through estuary rather than sites

Regional Bodies/LG Role?

- Adopt MER indicators now
- Supplement sampling
 - Additional estuaries
 - More intensive spatial/temporal
 - Special issues

CONCLUSIONS

- Understand your issues/pressures
- Conceptualise the system
- Choose outcome indicators relevant to the pressures
- Use the most suitable models to link pressures and outcomes and guide management



Do models have a use?

- Define Management Zones
- Link outcomes and management
- Inform where management will be most effective and costs
- Educate on the scale of change needed to improve environmental health

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Great Lakes Example

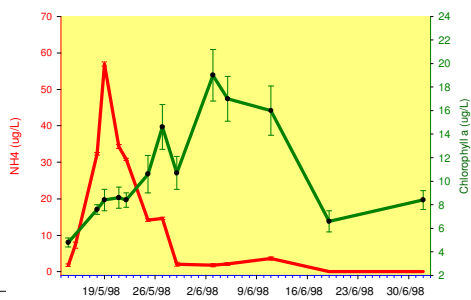
- Compare current condition to targets
- Model loads that will reduce chlorophyll to target levels
- Determine catchments that need improvement
- Model load reductions possible with various land management options
- Produce cost benefit profiles for catchment actions

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Rates of nutrient assimilation and algal growth

Tuggerah Lakes - Post Flood



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