



Australian Government  
Department of the Environment and Water Resources



Marine and Tropical Sciences Research Facility

## Integrated Report Card

### Conceptual and Statistical Framework for the Water Quality Component

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Information Sciences

Marine and Tropical Sciences  
Research Facility



### Outline

- Project/Task Objectives
- Key learnings from existing IRC frameworks
- Regionalisation methodology for the GBR and catchments
- Indicator assessment and integration
- Testing against management objective
- **Application:** The Tully
- Future directions



## The Project 2006/2007

- This project is about:
  - ◆ Developing a **framework** for integrated reporting on condition and trend in the GBR catchments.
- This framework includes the necessary components that would go into a report card:
  - ◆ Examining and developing appropriate methods for **regionalisation** which have the capacity to incorporate expert opinion
  - ◆ Examining and developing appropriate methods for **indicator assessment, indicator integration** and **compliance**.



## People Involved

- **CSIRO Mathematical and Information Sciences**

- ◆ Erin Peterson, Matthew Browne, Petra Kuhnert, Bronwyn Harch

- **CSIRO Land and Water**

- ◆ Rebecca Bartley, Anne Henderson, Vittorio Brando, Andy Steven,

- **Linkages with:**

- ◆ Reef Water Quality Partnership
- ◆ QEPA & QNRW (SEAP program)
- ◆ Other MTSRF programs

Statistics, Computational Skills, GIS, Past experience in report card development

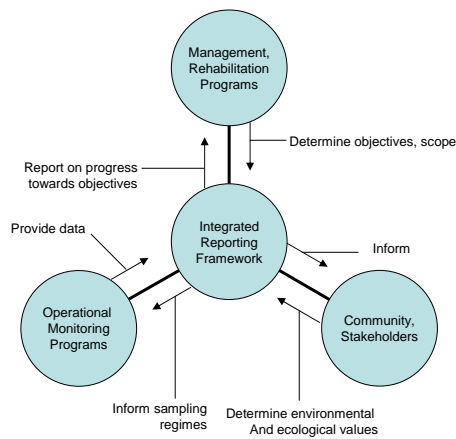
GIS, Knowledge of the region, processes, indicators & data

Domain experts and data custodians

Report Card Development

## Key Learnings

### Facilitating Report Card Development



## Key Learnings

### Scale and Time Frame

Location	Scale	Time Frame
South East Queensland	km <sup>2</sup>	2000, 2001
Chemical and Physical Assessment	km <sup>2</sup>	2000, 2001
State WA	km <sup>2</sup>	Work 1994. values, criteria 2000, First report 2001
Planned GBR Report	km <sup>2</sup>	?
	Ref: 344,000 km <sup>2</sup>	

"A robust science basis for IRCs takes time . . ."

## Key Learnings



### Take Home Messages from Existing IRCs

**PHASE 1:** Define the scope and objectives of the program, and establish what existing resources are available.

**Key Contributors:** managers, authorities government, scientists, community

**PHASE 2:** Understand the system. Conceptual frameworks and conceptual models play an important role here.

**Key Contributors:** water quality/social/economic domain experts with local expertise

**PHASE 3:** Establish a measurement framework that will address the constructs defined in phase 1 for the systems defined in phase 2.

**Key Contributors:** water quality/social/economic domain experts, Statisticians

**PHASE 4:** Establish an integration and reporting framework that will integrate and present the data generated in phase 3 in a valid manner.

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## Component 1: Regionalisation

### What is Regionalisation?

- ◆ Regionalisation is a fancy term that is used when we want to break up a region into similar "bits" based on information that is not subject to anthropogenic impact.
- ◆ The "bits" might represent
  - regions with similar types of geology, soil and climate characteristics (freshwater)
  - regions with similar types of depth or seabed characteristics (marine)

### Why is Regionalisation needed?

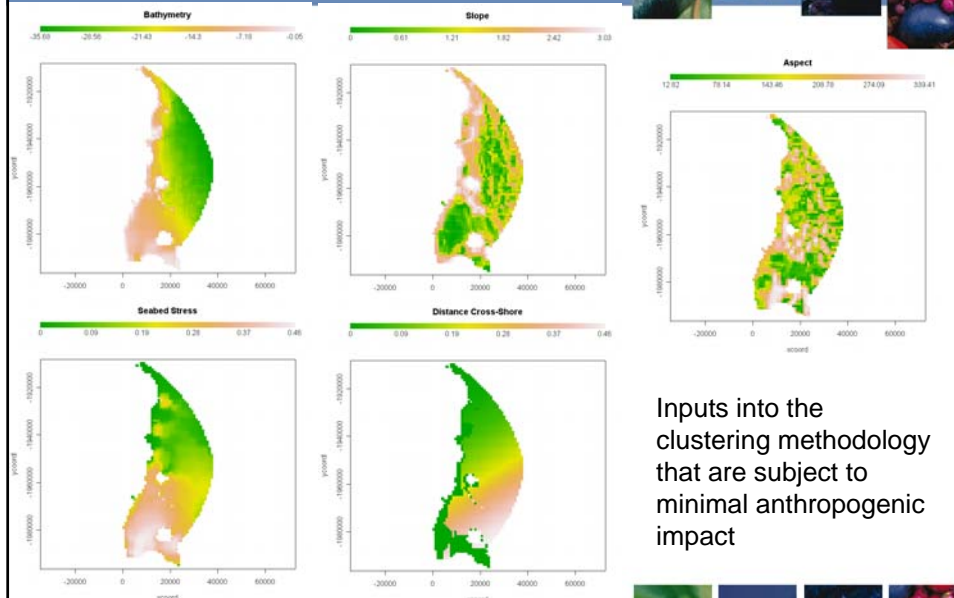
- ◆ When making an assessment about an indicator, we need to **compare the indicator** at sites that have similar physical characteristics (not subject to anthropogenic stresses).
- ◆ Reporting regions may be different to assessment regions.



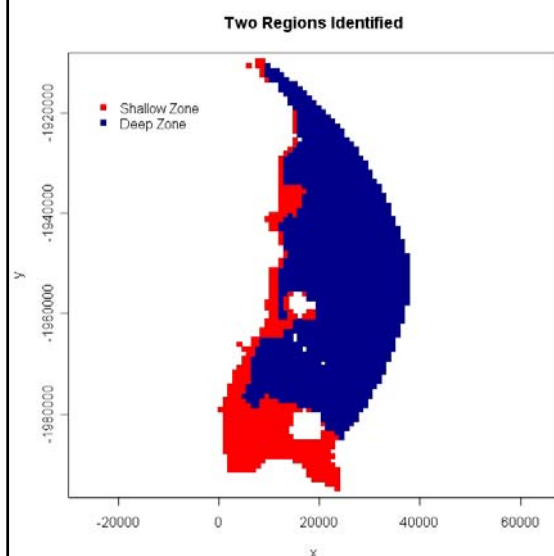
- Tully/Murray NRM marine extent
- Focus for the regionalisation

- Tully/Murray freshwater region
- Still processing data

## Physical Variables



## Regionalisation of the Tully Marine Extent

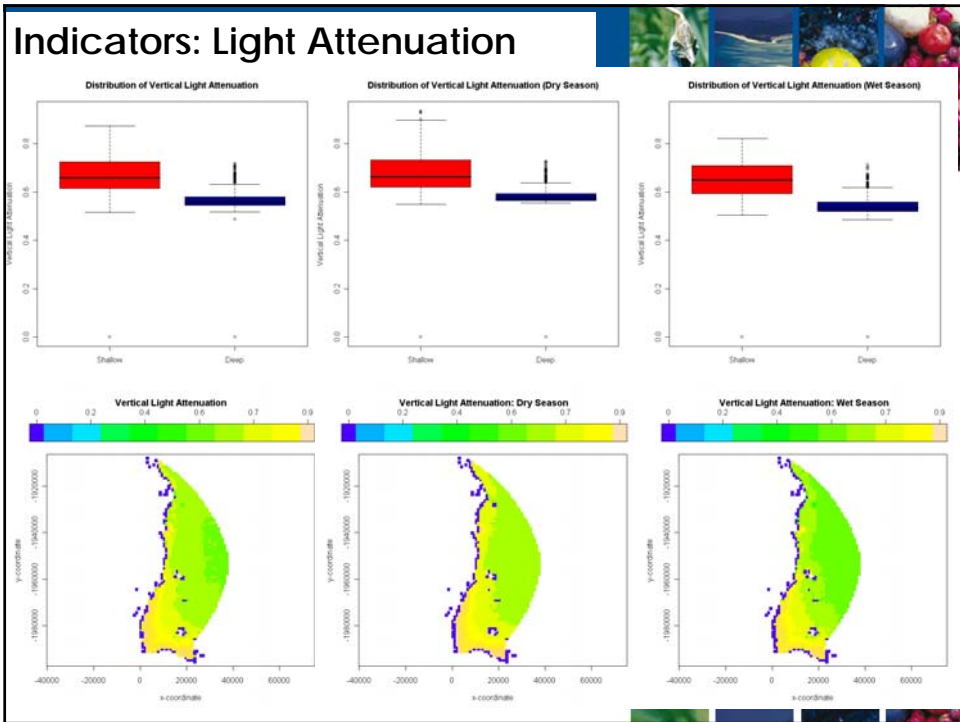
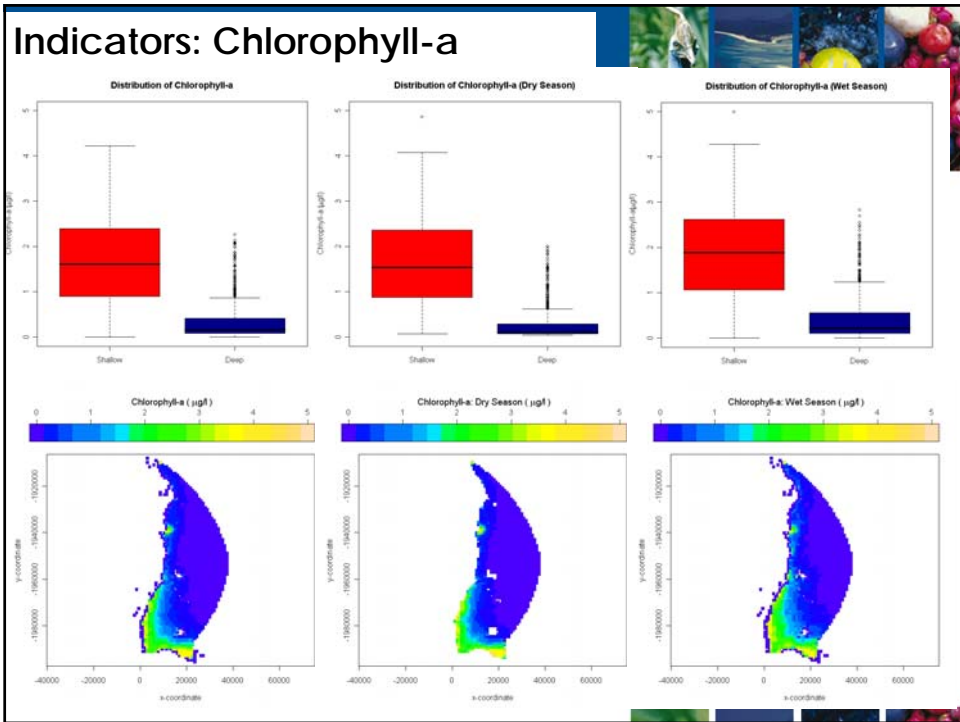


**Preliminary** clustering of the data using some standard cluster analysis techniques.

Segregation into shallow and deeper zones.

Seabed stress plays a role at coastal sites and sites north of Hichinbrook Island.

Experts should be consulted before final boundaries are set.



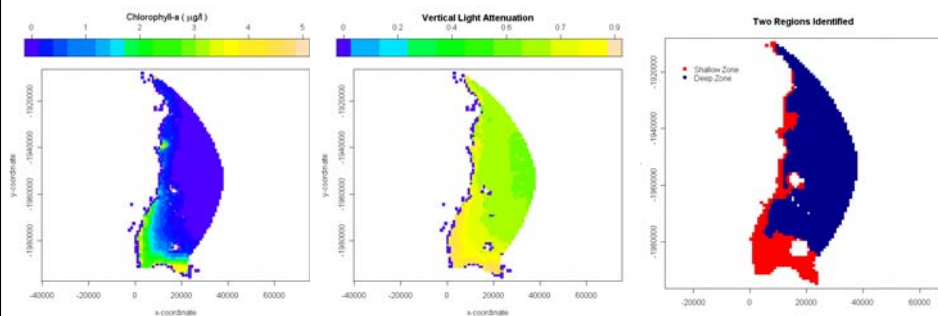
## Component 2: Indicators

- Examination of indicators
  - To determine which indicators are useful
  - Typically a pilot study is undertaken to examine indicators
- Some basic approaches to turning indicators into global measures of 'goodness' – 'badness'
  - Predictive models (e.g. O/E) indicators as function of environmental parameters given non-impacted conditions, compare to actual, assign residuals to human impact
  - Reference condition establish acceptable range for indicators based on minimally impacted sites for each region
  - Objectives / targets establish thresholds of concern based on management / science dialogue

## Marine and Tropical Sciences Research Facility

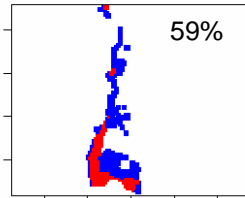
### Components of Integration

**Management Objective:** *improve water quality in marine zones*  
**Indicators:** Chl a, Vertical light attenuation  
**Thresholds of concern:** [2][1] ug/l [.75][.5] VA

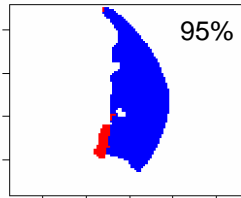


# Indicator Integration: An Example using the Tully

Chl a Exc. 2ug/l: Shallow Zone

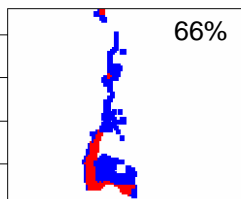


Chl a Exc. 1ug/l: Deep Zone

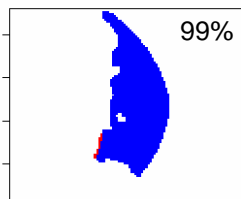


% Compliant Chlorophyll-a = 77%

Vert. Att. Exc. .75: Shallow Zone



Vert. Att. Exc. .5: Deep Zone



% Compliant for Marine = 79.8%

% Compliant Vertical Light Attenuation = 82.5%

% Compliant (Shallow) = 62.5%

% Compliant (Deep) = 97%

■ Areas which do not exceed the threshold  
■ Areas which do exceed the threshold

## Report Card Mock Up

### water quality report card

For the Great Barrier Reef and Adjacent Catchments 2006

Fitzroy River Catchment

2006 scores reflect improvements in the management of the Fitzroy

This section would contain interpretation of results. Get's dollar value with this and is a indicator. Because this report card is a indicator of water quality improvements, it's important to note that the scores are not a measure of water quality, but a measure of the progress of water quality improvements.

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#### Land Use Pressure



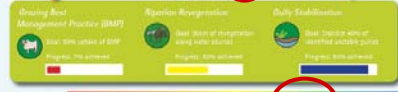
#### Water Quality



#### Reef Health



#### Management Efforts



LEGEND: Very Poor, Poor, Fair, Good, Very Good

#### Land Use



#### Rainfall



#### Sea Temperature



#### Environmental Flow



Scientists use crocodile eggs to detect pesticides in the Fitzroy

Pesticides are an issue of concern in the Fitzroy catchment. This is the result of run-off from agricultural crop management. To address this issue, scientists have devised an innovative and very interesting method of detecting pesticide levels using the country's most formidable reptilian predators.

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## Future Directions

- **Continued focus on water quality**
- **Improved methods to enhance management actions**
  - Regionalisation
    - "Operational": data + expert information
    - Incorporating uncertainty into models for regionalisation
  - Indicators
    - Examination of indicators through pilot study (if implemented)
    - Moving to a more robust basis using predictive models
  - Reporting
    - Assessments incorporating space and time
    - Moving to a more robust basis: towards a "degree of departure" as opposed to % compliant

## Cluster Analysis

