



Australian Government

Department of the Environment, Water, Heritage and the Arts

**Marine and Tropical Sciences Research Facility (MTSRF)
June 2007 Milestone Report**

Project 3.7.1 – Marine and Estuarine indicators and thresholds of concern

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Summary

All milestones have been completed. Since the last report on the 16th March, the following reports were completed and are attached to this Milestone Report:

- (1) use of foraminifera as indicators of changing water quality;
- (2) use of corals as indicators of changing water quality;
- (3) review of estuarine indicators; and
- (4) report on a conceptual model to understand the links between inshore ecosystem condition and changing water quality.

Four manuscripts have also been completed. A number of short field trips were used to service instruments to measure turbidity and the physiological responses of corals to changing turbidity. Members of the Project were involved in a workshop of the development of conceptual diagrams (23 May), and met with the GBRMPA WQ Group, and presented at the MTSRF WQ Conference 18h April.

For reference: Milestone extracted from Project Schedule

Report 3 submission

- Final report on use of marine biofilms as indicators for changes in water quality. [AIMS]
- Final report on the use of physiological measures in coral reef organisms as indicators of water quality and ecosystem condition (objective b). [AIMS]
- Final report on relationships between seagrass communities and sediment properties along the Queensland coast. [QDPI]
- Final report detailing the conceptual framework for reef ecosystem condition in relation to changing river discharges. [AIMS]
- Final report on literature review on potentially useful ecological indicators of the condition of North Queensland's estuaries [JCU, GU].

Final summary of liaison activities undertaken through course of year 1 of project. [AIMS]

Project Results

Description of the results achieved for this milestone

1. Final report on use of marine biofilms as indicators for changes in water quality. [AIMS]

Completed, see attached. The biofilms research has mostly focused on foraminifera as probably the most effective and versatile group of biofilms biomarkers in the reporting period. A series of experiments and transplantation field experiment have been completed, which involved 2 field trips to the Whitsunday for deployment and retrieval. Two manuscripts on the role of foraminifera as indicators for water quality conditions have now been completed.

2. Final report on the use of physiological measures in coral reef organisms as indicators of water quality and ecosystem condition (objective b). [AIMS]

Completed, see attached. In this report we quantitatively assessed and compared coral-based indicators at a range of spatial and temporal scales and identified those most suitable for inclusion into a 'toolbox' for monitoring the health of nearshore reefs on the GBR. In the reporting period since March, the analyses of all physiological samples has also been completed, and results statistically analysed. Furthermore, a manuscript proposing the use of light, together with chlorophyll, as integrative and ecologically relevant proxy measure for changes in water quality, and the effect of light limitation on reef development in the Whitsundays has been completed and is now accepted for publication.

3. Final report on relationships between seagrass communities and sediment properties along the Queensland coast. [QDPI]

The conversion of all sediment properties data to quantitative measure apportioned by grain size has been completed for the whole Seagrass-Watch data set. The conversion is based on the CRC Deepwater seagrass survey sediment data (for which both deck descriptions and grain size analyses exist). This allowed to back-relate the "deck description" type seagrass watch data to grain sizes. With this conversion completed, this extensive data set represents a fantastic resource to quantitatively investigate the relationships between seagrass meadow properties (species composition, biomass etc) and sediment properties, as well as spatial and temporal factors. To complete such statistical analyses and the write-up of this complex and large research project will require more substantial investment than was available this year.

4. Final report detailing the conceptual framework for reef ecosystem condition in relation to changing river discharges. [AIMS]

Completed, see attached. The objective of this study was to build a conceptual model to address the specific question: "How are changes in river loads linked to changes in lagoonal water quality and biogeochemical processes, and do these changes alter the condition and ecological properties of coral reefs"? The conceptual model summarises the present understanding of the processes involved the dynamics of nutrients, sediments, and their effect on the condition of inshore coral reefs of the GBR. The model combines published process understanding, budgets and reviews including Furnas et al. (1995); Furnas (2003); Wolanski et al. (2004); Alongi and McKinnon (2005); Fabricius (2005); Schaffelke et al. (2005), and Fabricius et al. (2007). This conceptual model may now be used to populate a process-based numerical model to test scenarios / model risks in relation to changes in water quality, to design conceptual diagrams as communication tools, and to identify future research priorities.

5. Final report on literature review on potentially useful ecological indicators of the condition of North Queensland's estuaries [JCU, GU].

Completed, see attached. In total, 565 references were collected, reviewed and synthesized, and a summary of recommendations have been provided. The study showed that while there is a large amount of information about detecting impacts and measuring ecosystem health in temperate estuaries, the extent to which temperate approaches are transferable to tropical/subtropical systems is unclear. There have been no location-specific studies evaluating the appropriateness of extrapolation from temperate to tropical understanding. In particular, biochemical processes such as toxicity, persistence and accumulation rates are likely to differ between cooler temperate and warmer tropical systems). Contrasts in functioning of tropical compared to temperate estuaries are likely to be compounded by the much higher biological diversity present in tropical estuaries, which potentially leads to more complex ecological processes. High diversity might also equate to high variability, adding another layer of complexity.

Ecosystem health is a combination of three factors: resistance, organisation and vigour, all of which are ultimately functions of ecological processes. Ecosystem health might therefore be considered as more closely aligned with the integrity of ecological processes than the health or abundance of individual species or groups of species. The study suggests that definitive measurement of ecosystem health requires approaches that provide measures of the integrity of ecological processes.

6. Final summary of liaison activities undertaken through course of year 1 of project. [AIMS]

Members of the Project were involved in a series of meetings and workshops with the Reef Partnership, GBRMPA, CSIRO and other MTSRF partners throughout the year.

- For example, the Reef team held a 2-days workshop with MTSRF Team 1.1.5 (Glenn De'ath and Bill Venables) to discuss statistical aspects of indicator development and decide on collaboration. Outcomes of this workshop will be reported through 1.1.5.
- The Reef team contributed to a Workshop to develop and decide on Reef Plan Marine Monitoring methods for the coming years (15th and 16th March).
- K. Fabricius participated in the Integrated Report Card Framework held in Brisbane on the 5th March.
- K. Fabricius met with GBRMPA, Reef Partnership and other MTSRF Projects to discuss the joint development of a Conceptual Model on land-sea interactions, and the effects of water quality on reef health.
- Members of the Project were involved in a workshop organised by the Reef Partnership and GBRMPA on the development of conceptual diagrams of WQ – reef health (23 May).
- K. Fabricius participated in meetings with GBRMPA to discuss scientific underpinning of the Water Quality Guidelines, and a series of other topics of concern (future focus on pesticide work, etc).
- K. Fabricius participated in meetings of the MTSRF WQ Operationals Committee, and presented a talk at the MTSRF WQ Conference (18h April).
- and data sharing agreement.

Communications, major activities or events

During milestone reporting period

- Members of the Project were involved in a workshop of the development of conceptual diagrams (23 May), met with the GBRMPA WQ Group, and presented a talk at the MTSRF WQ Conference 18h April.
- Four manuscripts and four reports have been completed that will aid communication with the scientific community.
- The Catchment-to-Reef Report has been handed out to major end users (NRM Mackay, EPA, Partnership, GBRMPA etc) and is about to be uploaded onto the RRRRC web site.

During next milestone reporting period

We aim at starting to work on the research outlined in the ARP2 as detailed in the submitted proposal without delay

Forecast variations to planned milestones

We aim at entering into ARP2 as proposed.

Objective	Targeted Activity	Date
a	Field testing and analysis of marine biofilms (bacteria, diatoms, foraminifera) for their suitability to indicate changes in water quality. [AIMS]	10 June 2007
b	Field testing and analysis of coral reef organisms and physiological change tested for their suitability to indicate changes in water quality and ecosystem condition. [AIMS]	10 June 2007
c	Report on relationships between seagrass communities and sediment properties along the Queensland coast. [QDPI]	10 June 2007
d	Analysis of stress markers in estuarine barramundi in response to contrasting water quality in four estuaries. [AIMS]	March 2006
b	Contribute to GBR workshop held on reef health indicators and thresholds of concern with program 1.1.2 [AIMS]	Dec 2006
b	Contribute to integration workshop to define end-user needs for reporting on issues related to freshwater water quality and ecosystem health. [AIMS]	
d	Literature review on potentially useful ecological indicators of the condition of North Queensland's estuaries [JCU, GU]	10 June 2007
b	Conceptual framework for reef ecosystem condition in relation to changing river discharges. [AIMS]	10 June 2007