Australian Government

Great Barrier Reef Marine Park Authority

SCIENTIFIC INFORMATION NEEDS

FOR THE MANAGEMENT OF THE GREAT BARRIER REEF MARINE PARK

2009 – 2014

INTRODUCTION

The purpose of this document is to facilitate discussion between scientists and Marine Park managers about research and monitoring that will help inform Marine Park management, especially high priorities. It is a framework for integrating science into the management of the Marine Park.

The Great Barrier Reef Marine Park Authority (GBRMPA) uses the best available scientific information in many ways, including:

- Measuring impacts on the Reef (including cumulative impacts)
- Identifying emerging risks to the Reef
- Defining objectives (including targets)
- Setting triggers for management intervention
- Developing policy and management strategies and assessing performance
- Providing expert advice
- Making decisions (for example permits and impact assessments)
- Raising awareness (communication and education)
- Developing community partnerships based on shared understanding
- Preparing reports and analysis.

The scientific information needs of the GBRMPA require both research and monitoring. While some science needed is clearly one or the other, other science may have characteristics of both.

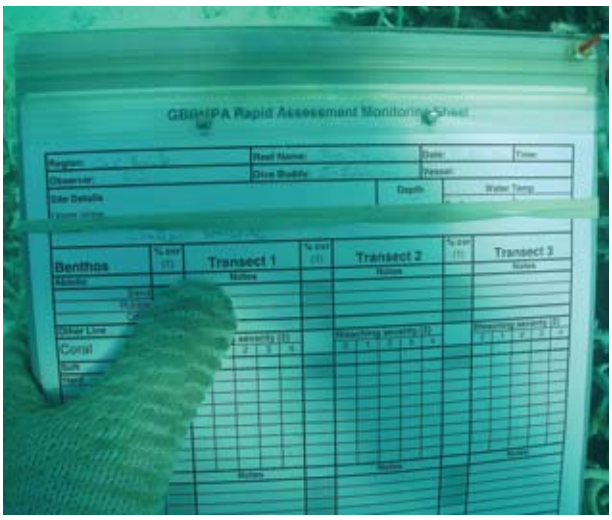
To facilitate the delivery of the science needed to manage the Marine Park, the GBRMPA has twice published sets of explicit scientific information needs, once in 2001 and then again in 2005. This document is the latest update in the series.

There are a number of other ways in which the GBRMPA can help facilitate the delivery of the science needed to manage the Marine Park including:

- Articulating problems
- Framing specific questions
- Assisting in project design
- Providing letters of support for grant applications
- Providing funding (although direct funding from the GBRMPA is limited)
- Advising on the most useful form and timing of delivery
- Helping interpret science for government and the public
- Facilitating policy and operational outcomes from science.

In order to maximise the usefulness of any given scientific project it is important that scientists and managers collaborate throughout the life cycle of the project - from initial planning right through to analysis and reporting.

Further detail on present and planned policy, position statements and plans of management as well as current management initiatives and detailed research questions (where available) are available through a supporting web based resource. The Outlook Report 2009 and the *Great Barrier Reef Marine Park Act 1975* are also available online at www.gbrmpa.gov.au



Translating information needs into research for management

The following four steps can help determine whether research is likely to be useful to Marine Park management.

1 – Determine whether the issue is of concern to management.

2 – Establish the adequacy of available information on the issue.

3 – Determine the feasibility of researching the question within reasonable time and resource constraints.

4 – If the research question was answered, would it facilitate the GBRMPA to better achieve its objectives? For example, would it lead to improvements in the way the Marine Park is managed, or raise public awareness? Are there likely to be tangible management options to address the issue?

This document gives guidance relevant to **Steps 1** and **2** (in particular see **Tables 2 – 5**). **Steps 3** and **4** are then best considered as a basis for discussion between researchers and managers when planning and prioritising research and monitoring programs.

Photo courtesy of Len McKenzie, Fisheries Queensland

Photo courtesy of Dave Williams, AIMS

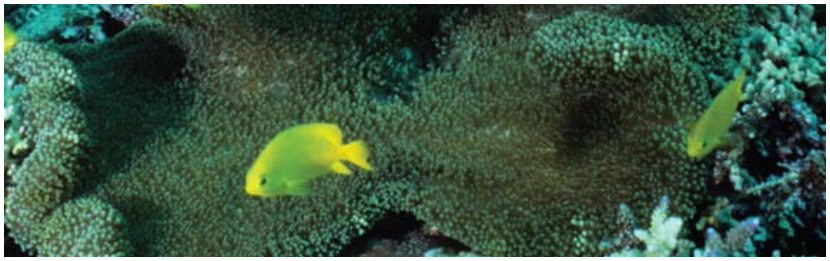
OVERARCHING QUESTIONS

The Great Barrier Reef Marine Park Authority has five overarching research questions (Table 1). These centre on how natural resource management can be improved to protect the environmental, economic and social values of the Great Barrier Reef. These questions were generated by considering the key risks to the Reef ecosystem (as identified in the *Great Barrier Reef Outlook Report 2009*), management options for reducing the risks and the knowledge needed to implement those options.

Each of these questions is necessarily underpinned by other questions about condition and trends in natural resources and pressures on those resources. Delivering the answers to these questions will require several approaches, including: monitoring of key ecosystem components (including goods and services); synthesising existing research results; and effective and long-term institutional arrangements for data collection and management to ensure research results are put to best use and duplication of effort is avoided.

Table 1 | Overarching research questions

Question	Why is it important?
How can we best understand and manage the cumulative impacts of multiple pressures on the Great Barrier Reef ecosystem and the goods and services it provides?	• Increasing pressure on the Great Barrier Reef from a range of factors • Few comprehensive, scientifically based sources to base increasingly frequent decisions about permitting sustainable use • Effective resource management, in some cases, needs to cover large scales due to highly connected and interdependent marine and terrestrial environments • A lack of strategic status information and integrated assessments of accumulating effects.
What are the effects of existing management strategies on the Great Barrier Reef ecosystem?	• Management agencies need to know if implemented strategies are reducing risks • Requires understanding of how affected ecosystem components are responding • Best done with an understanding of current condition and trends in ecosystem status, particularly in monitoring recovery after disturbance (assessment of resilience) and following management interventions (effectiveness of management).
What adaptation strategies, including improvements to current management and completely novel strategies, could be used to improve the Great Barrier Reef's resilience (particularly in the face of climate change)?	• Assessment and priority of effectiveness of current and possible future strategies to address major risks to the Marine Park • If future management is to reduce the forecast effects of climate change and other identified risks, innovative strategies and arrangements are essential • Government and industry will need to think outside the square to safeguard the marine environment – business as usual is not an option • Intervention may include more active restoration of existing damage to accelerate natural processes of resilience.
How can catchment and nearshore management strategies (planning and decision making across all uses) in the Reef catchment be improved to better protect coastal ecosystems adjacent and connected to the Reef and to improve water quality, ecosystem health and ecosystem resilience of the Great Barrier Reef?	• Understanding links between coastal ecosystems and their influence(s) on the Reef ecosystems enables all levels of biodiversity conservation to be handled at a landscape/ecosystem level where delivery of outcomes has failed in the past • New planning responses are needed to prevent the incremental decline in biodiversity • Key issues are poor water quality (noting agriculture is important but not the only driver) and loss or modification of habitats in coastal and nearshore areas • Information would feed directly into strategic assessments on a regional scale.
How can the fisheries of the Great Barrier Reef and adjacent areas be best managed to maximise ecosystem health, ecosystem resilience and ecosystem goods and services?	• Individual and cumulative ecological effects of the various uses of Marine Park resources must continue to be carefully assessed and managed • Management responses must adapt to changing environmental and market conditions • Effective management outcomes depend on integrating economic, social and environmental information and making it easily accessible • Informed and responsible purchasing will increasingly drive innovations in sustainable harvesting and production methods.



FRAMEWORK FOR GBRMPA'S SCIENTIFIC INFORMATION NEEDS BASED ON THE OUTLOOK REPORT 2009

How these scientific information needs were determined

Since the last scientific information needs update in 2005, the *Great Barrier Reef Marine Park Act 1975* (the Act) has been amended to include a requirement to publish a five yearly Great Barrier Reef Outlook Report. The Outlook Report is now the GBRMPA's primary reporting mechanism and the first Report was released in September 2009. In developing the Outlook Report, the GBRMPA compiled and synthesised the best available scientific information relevant to management of the Marine Park. In doing so, requirements for future scientific information needs have been identified.

The Outlook Report assesses the current state of the environmental, social and economic values of the Great Barrier Reef. It also examines pressures and current responses, and finally considers the likely outlook. Values and pressures are considered under eight assessments, which are broken down to assessment criteria and assessment components. For further information on Outlook assessments, assessment criteria and assessment components, please see the Outlook Report 2009 (www.gbrmpa.gov.au).

Although we consider, for example, components of biodiversity and ecosystem health as distinct entities, it is critically important to recognise that all these entities are inter-connected, that the ecosystem operates as a whole, and that the whole is greater than the sum of the parts. Similarly, we consider various pressures on the ecosystem as distinct entities, but it is the interaction between pressures, and in particular their cumulative impacts, that are often of greatest concern. Further, complex interactions between biodiversity, ecosystem health and cumulative impacts determine the resilience of the ecosystem, a concept which is fundamental to the protection of the Marine Park.

This Framework is structured in table format to depict the interactions between the Outlook Report assessment components (See Tables 2-5). It shows the level of concern to management and the current adequacy of knowledge to help identify priority information gaps that need to be addressed.

Meeting these needs will improve the information base for decision-making in relation to the Great Barrier Reef ecosystem, as well as help better inform future Outlook Reports.

The broad questions around the assessment and assessment criteria of the Outlook Report are described below. Tables 2-5 then provide more detailed information on how individual components interact with each other.

ASSESSMENT: BIODIVERSITY

Assessment criterion: Habitats to support species

What is the distribution of, condition of, and drivers of change in habitats to support species? Specifically, the Outlook Report 2009 considers the following assessment components: islands; beaches; mangroves; seagrass meadows; coral reefs; lagoon floor; shoals; *Halimeda* banks; continental slope and open waters. See Table 3.

The Outlook Report 2009 also identifies the pressures on coastal ecosystems, especially coastal wetlands, from coastal development, as a significant issue.

Assessment criterion: Populations of species and groups of species

What is the distribution of, condition of, and drivers of change for species or groups of species? Specifically, the Outlook Report 2009 considers the following assessment components: mangroves; seagrass; macroalgae; benthic microalgae; corals; other invertebrates; plankton and microbes; bony fish; sharks and rays; marine turtles; sea snakes; estuarine crocodiles; seabirds; whales; dolphins and dugongs. See Table 3.

ASSESSMENT: ECOSYSTEM HEALTH

Assessment criterion: Physical processes

What is the status of physical processes, how are they supporting the species and habitats listed under 'Biodiversity', and how are they being affected by the pressures listed under 'Factors influencing the Reef's values'? Specifically, the Outlook Report 2009 considers the following assessment components: ocean currents; cyclones and wind; freshwater inflow; sedimentation; sea level; sea temperature; and light. See Table 4.

Assessment criterion: Chemical processes

What is the status of chemical processes, how are they supporting the species and habitats listed under 'Biodiversity', and how are they being affected by the pressures listed under 'Factors influencing the Reef's values'? Specifically, the Outlook Report 2009 considers the following assessment components: nutrient cycling; pesticide accumulation; ocean acidity; and ocean salinity. See Table 4.

Assessment criterion: Ecological processes

What is the status of ecological processes, how are they supporting the species and habitats listed under 'Biodiversity', and how are they being affected by the pressures listed under 'Factors influencing the Reef's values'? Specifically, the Outlook Report 2009 considers the following assessment components: microbial processes; particle feeding; primary production; herbivory; predation; symbiosis; reef building; competition; and connectivity. See Table 4.

Assessment criterion: Outbreaks of disease, introduced species and pest species

What are the causes, incidence rates and consequences to the habitats and species listed under 'Biodiversity' of disease, introduced species and pest species? Specifically, the Outlook Report 2009 considers the following assessment components: outbreaks of disease; crown-of-thorns starfish outbreaks; introduced species; and other outbreaks. See Table 4.

ASSESSMENT: COMMERCIAL AND NON-COMMERCIAL USE

What are the environmental, social, economic and cultural benefits of commercial and non-commercial use, and what are the impacts, including cumulative impacts? How do these benefits depend on the habitats and species listed under 'Biodiversity' and the processes listed under 'Ecosystem health'? Specifically, the Outlook Report 2009 considers the following assessment components: commercial marine

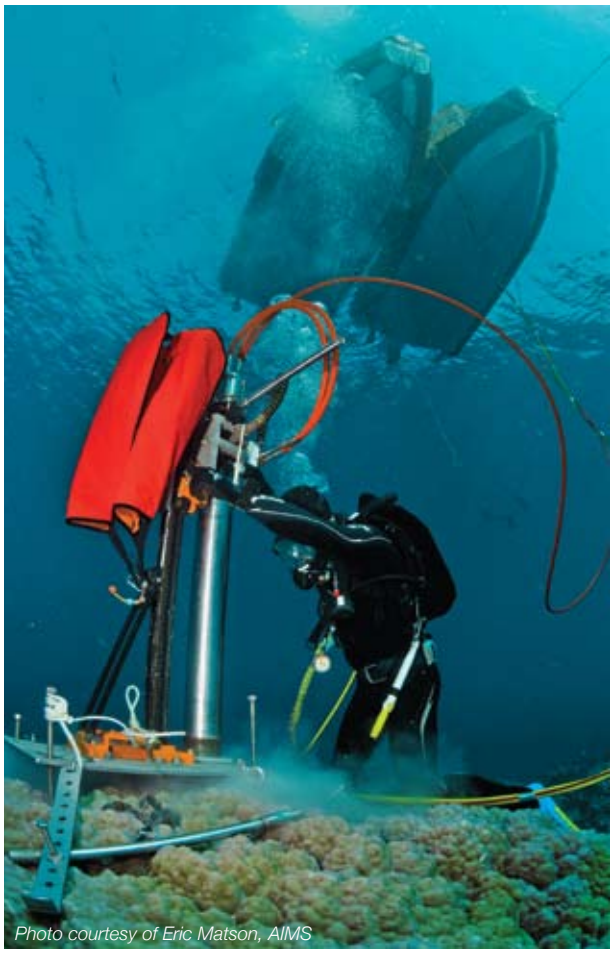


Photo courtesy of Eric Matson, AIMS

tourism; defence; fishing; ports and shipping; recreation (not including fishing); scientific research and traditional use of marine resources. See Tables 3, 4 and 5.

ASSESSMENT: FACTORS INFLUENCING THE REEF'S VALUES

What are the impacts, including cumulative impacts of climate change, coastal development, catchment run-off, and direct use (as detailed under the assessment 'Commercial and Non-commercial Use') on environmental values (the habitats and species listed under 'Biodiversity', and the processes listed under 'Ecosystem health'),as well as economic and social values (listed under 'Commercial and non-commercial use)? See Tables 3, 4 and 5.

ASSESSMENT: ECOSYSTEM RESILIENCE

What are the patterns of recovery after disturbance of different components of the ecosystem? For example, the Outlook Report 2009 considers the following assessment components: coral reef habitats; lagoon floor habitats; black teatfish; coral trout; loggerhead turtles; urban coast dugongs; and humpback whales.

Table 2 Guide to interpreting tables 3-5

Note that the 'degree of concern to management' and 'adequacy of information' are inter-dependant. For example, in all cases where the score of 'adequacy of information ' is 'low', the corresponding score for 'degree of concern to management' has a low level of certainty, precisely because the information available is inadequate. Where adequacy of information is 'good', existing sources of information, including on-going monitoring, should be maintained.

Adequacy of information	Degree of concern to management: High	Moderate	Low
Good	Management has a high level of concern for the value due to its current degraded condition and/or the high level of single or cumulative pressures affecting it. Management has high confidence in this score. The good level of information available directly supports management decisions and is currently sufficient to allow progress on the particular issue/interaction. However, further information to support ongoing adaptive management may still be required.	Management has a moderate level of concern for the value due to its current condition and/or the moderate level of single or cumulative pressures affecting it. Management has high confidence in this score. The good level of information available directly supports management decisions and is currently sufficient to allow progress on the particular issue/interaction. However, further information to support ongoing adaptive management may still be required.	Management has a low level of concern for the value due to its current good condition and/or the low level of single or cumulative pressures affecting it. Management has high confidence in this score. The good level of information available directly supports management decisions and is currently sufficient to allow progress on the particular issue/interaction. However, further information to support ongoing adaptive management may still be required.
Moderate	Management has a high level of concern for the value due to its current degraded condition and/or the high level of single or cumulative pressures affecting it. Management has a moderate level of confidence in this score. The moderate level of information gives a reasonable basis for management decisions, but decisions regarding some aspects of the issue/interaction may be hampered by current knowledge gaps.	Management has a moderate level of concern for the value due to its current condition and/or the moderate level of single or cumulative pressures affecting it. Management has a moderate level of confidence in this score. The moderate level of information gives a reasonable basis for management decisions, but decisions regarding some aspects of the issue/interaction may be hampered by current knowledge gaps.	Management has a low level of concern for the value due to its current good condition and/or the low level of single or cumulative pressures affecting it. Management has a moderate level of confidence in this score. The moderate level of information gives a reasonable basis for management decisions, but decisions regarding some aspects of the issue/interaction may be hampered by current knowledge gaps.
Low	Management has a high level of concern for the value due to its current degraded condition and/or the high level of single or cumulative pressures affecting it. Management has low confidence in this score. The low adequacy of information is a hindrance to management. Decisions are either pending the availability of improved scientific understanding of the issue/interaction or are made with consideration of the Precautionary Principle.	Management has a moderate level of concern for the value due to its current condition and/or the moderate level of single or cumulative pressures affecting it. Management has low confidence in this score. The low adequacy of information is a hindrance to management. Decisions are either pending the availability of improved scientific understanding of the issue/interaction or are made with consideration of the Precautionary Principle.	Management has a low level of concern for the value due to its current good condition and/or the low level of single or cumulative pressures affecting it. Management has low confidence in this score. The low adequacy of information is a hindrance to management. Decisions are either pending the availability of improved scientific understanding of the issue/interaction or are made with consideration of the Precautionary Principle.

Table 3 Scientific information needs for biodiversity components

This table indicates the ways in which factors influencing the Marine Park affect different elements of biodiversity (habitats and groups of species). The column titled Overall Status includes cumulative impacts on that component.

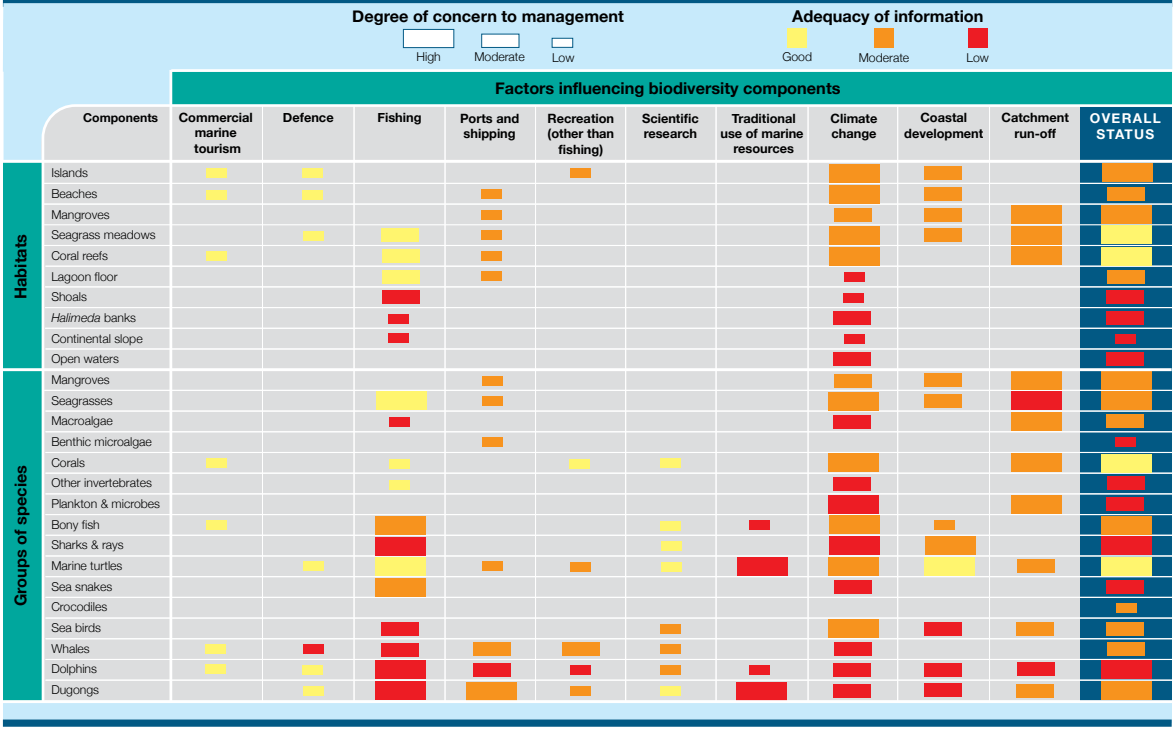


Table 4

Scientific information needs for ecosystem health components

This table indicates the ways in which factors influencing the Marine Park affect different elements of ecosystem health (physical, chemical and ecological processes) as well as outbreaks of disease, introduced species and pest species. The column titled Overall Status includes cumulative impacts on that component.

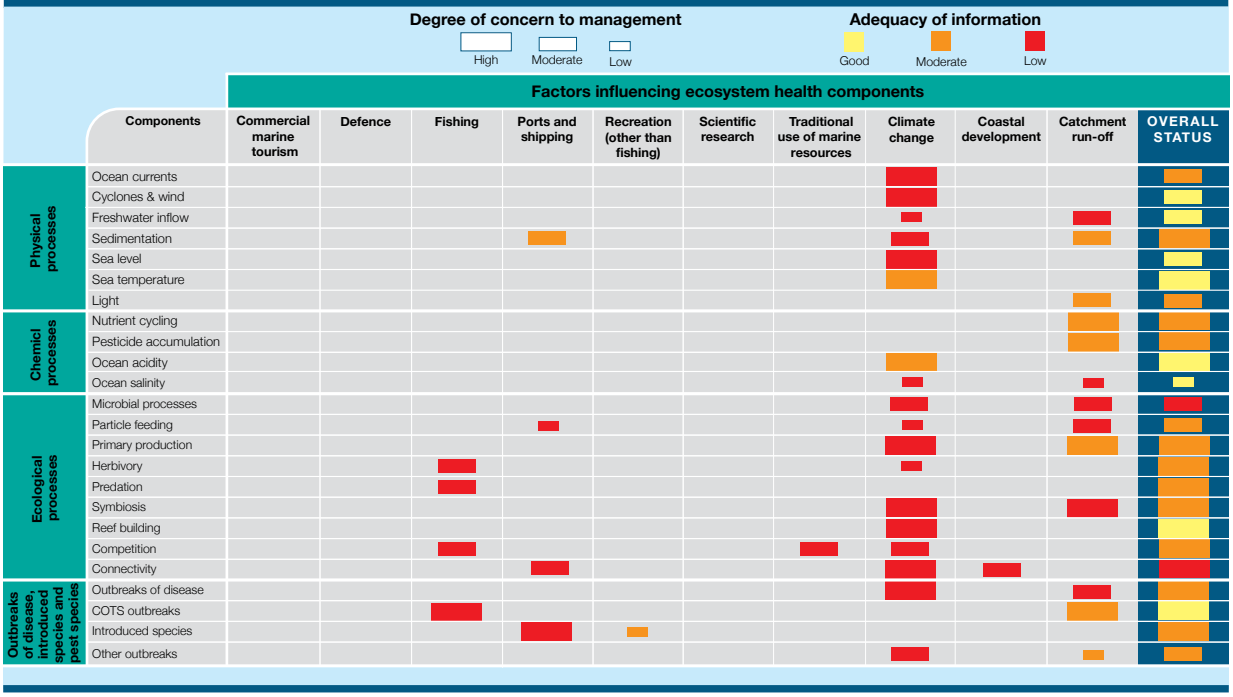


Table 5

Scientific information needs for benefits of use

This table indicates the ways in which factors influencing the Marine Park affect the social, economic and cultural benefits derived from different uses of the Marine Park. The column titled Overall Status includes cumulative impacts on that component.