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## Developing a long-term outlook for the Great Barrier Reef, Australia: A framework for adaptive management reporting underpinning an ecosystem-based management approach

Kirstin Dobbs<sup>a,\*</sup>, Jon Day<sup>a</sup>, Hilary Skeat<sup>a</sup>, John Baldwin<sup>a</sup>, Fergus Molloy<sup>a</sup>, Laurence McCook<sup>a</sup>, Margaret Johnson<sup>a</sup>, Bruce Elliot<sup>a</sup>, Andrew Skeat<sup>a</sup>, Karen Vohland<sup>a</sup>, David Wachenfeld<sup>a</sup>, Richard Kenchington<sup>b</sup>

<sup>a</sup> Great Barrier Reef Marine Park Authority, P.O. Box 1379, Townsville, Qld. 4810, Australia

<sup>b</sup> P.O. Box 588, Jamison, ACT 2614, Australia

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### ABSTRACT

The *Great Barrier Reef Outlook Report 2009* was the first produced in response to a newly legislated requirement for five-yearly reports on the status of and outlook for the Great Barrier Reef. It adopted an ecosystem approach, assessing all habitats and species, ecosystem processes and major uses. By then considering the factors affecting the ecosystem, coupled with an assessment of management effectiveness, it provided a risk-based forward-looking projection for the ecosystem. Rarely has such a comprehensive, ecosystem-based report been produced to guide government action. With no pre-determined path to follow for interpreting the legislative requirements, the Great Barrier Reef Marine Park Authority (GBRMPA) developed a repeatable structure and method for Great Barrier Reef Outlook Reports that impartially and consistently considers the evidence and clearly presents the findings. The GBRMPA worked closely with relevant Australian and Queensland Government agencies as well as researchers, industry representatives and the community while developing the report. That such a report must be produced every five years allows an overview of the effectiveness of management responses to be regularly assessed. It also provides a transparent means of highlighting and tracking emerging risks facing the Great Barrier Reef.

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### 1. Introduction

The Australian Government, through the Great Barrier Reef Marine Park Authority (GBRMPA), has responsibility for the Great Barrier Reef Marine Park (GBRMP), and the GBRMPA is the agency responsible for overall protection and management of the GBRMP. The GBRMP is managed as a multiple-use park, with reef-based industries and activities reliant on the Reef's natural values contributing an estimated gross value of product per annum of \$5.4 billion to the Australian economy [1].

Managing this complex marine park requires balancing reasonable human use with maintenance of the area's natural and cultural integrity. The enormity of the task is due, in part, to the sheer size (344,400 km<sup>2</sup>) and ecological diversity [2] of the GBRMP, its economic importance [1], the local, state, national and international interests in the area and the jurisdictional complexities [3]. Moreover, the close proximity of rural and urban populations, the range of users and interest groups and the need for equity and fairness in facilitating use and access to the GBRMP are all factors

that the management and policy framework need to consider. The GBRMP use patterns and technology that are constantly changing, and the marine environment itself is dynamic—subject to both human use and natural impacts. Despite these complexities, the integrated governance and management model that has been in place, with minor amendments, over the last 30 years has proven to be effective and successful. Indeed, it is widely regarded as such in marine and coastal management circles around the world [4–6].

In 2006, a review of the *Great Barrier Reef Marine Park Act 1975* (the Act) highlighted a need for information about the Great Barrier Reef (GBR) to be more transparent and publicly available, and recommended a regular and reliable means of assessing performance of the long-term protection of the Great Barrier Reef (GBR) [3]. It was envisaged that such information would be a key input into consideration of broader management issues for the GBR by the government [3]. This led to, *inter alia*, an amendment to the Act, requiring the GBRMPA to prepare a Great Barrier Reef Outlook Report every five years, based on eight specified assessments (see Section 2.1), with the first report to be provided to the Australian Minister for the Environment by 30 June 2009.

At the same time, the objects of the Act were amended to include a requirement that the Act regulates ... use of the Great Barrier Reef

\* Corresponding author. Tel.: +61 7 4750 0721; fax: +61 7 4772 6093.

E-mail address: [kirstin.dobbs@gbmpa.gov.au](mailto:kirstin.dobbs@gbmpa.gov.au) (K. Dobbs).

Marine Park in ways consistent with ecosystem-based management and the principles of ecologically sustainable use (2(3d)). Ecosystem-based management (EBM) is defined in the Act as an integrated approach to managing an ecosystem and matters affecting that ecosystem, with the main object being to maintain ecological processes, biodiversity and functioning biological communities.

The EBM concept has gained prominence because of the increasing recognition of the connections between different species and stocks that previously have been managed individually. With an international history dating back to the *Convention for the Conservation of Antarctic Marine Living Resources 1982* (CCAMLR), the concept of EBM gained widespread international acceptance at the Earth Summit in Rio in 1992 [7], and became an underpinning concept of the subsequent *Convention on Biological Diversity 1993* and the United States Consensus Statement on EBM [8].

A key principle of EBM is adaptive management. Adaptive management is often defined as a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs [9]. Walters [10] identified four basic issues in designing adaptive management strategies, briefly described as (i) bounding management problems, (ii) representation of existing understanding, (iii) representation of uncertainty and (iv) design of balanced policies. This paper describes the process of developing the Great Barrier Reef Outlook Report 2009, the lessons learned from the process and how such a report can provide a framework for adaptive management reporting that underpins an EBM approach.

## 2. Developing the Great Barrier Reef Outlook Report 2009

The area examined in the *Great Barrier Reef Outlook Report 2009* (the Report) [11] is the GBR Region as defined in the Act. The Region's boundaries match those of the GBRMP, except that the Region includes areas around major ports (Fig. 1). The report assessed all parts of the ecosystem within the Region, including everything from mangroves and seagrass meadows to coral reefs and the open ocean; all of these components are referred to as the GBR ecosystem. Where relevant, the report also looked beyond the boundaries of the Region and included information about adjacent islands, neighbouring marine areas and the catchment.

A *Framework for Preparation of the 2009 Outlook Report for the Great Barrier Reef Region* was prepared, which broadly outlined the aim, scope and key elements of the report; engagement with the Queensland and Australian Government agencies and the community, including scientists; the role and functioning of an Outlook Reference Group (see Section 2.3); the peer-review process; and publication plans. Key aspects of the framework were made publicly available on the GBRMPA website. The major stages of developing the report were structure; evidence; engagement and advice; and design and release.

### 2.1. Structure

The report and its supporting information were structured around eight assessments required by the Act, with each forming a chapter of the report. The broad logic was to report on the current state of the GBR ecosystem's environmental, social and economic values (assessments of biodiversity, ecosystem health and commercial and non-commercial use), examine the pressures and current responses, including the factors influencing these values, how management has made a difference, how well the Reef is able to recover from disturbance and the remaining risks to the Reef. These chapters build to an assessment of the long-term outlook for the GBR (Fig. 2).

For each assessment required under the Act, a set of assessment criteria (comprising one or more components) was developed, allowing an ordered analysis of the available evidence. For each criterion, grading statements guided the allocation of a 'grade of best fit' (Fig. 3). A qualitative grading system was considered appropriate as it allowed a wide range of evidence and knowledge to be collectively assessed when assigning each grade. More quantitative approaches were impractical given the size of the ecosystem, the amount of evidence available, the lack of analytical resources and the variety of components to be assessed. Four grading options (usually Very Good, Good, Poor, Very Poor) precluded the natural tendency to 'sit on the fence' in allocating a grade. At the end of each assessment is a summary, including the grades allocated (Fig. 4).

The assessment logic of the long-term outlook was one of the most difficult assessment logics to develop, with no precedents in other reports. The qualitative 'long-term outlook' assessment was based on identified risks and already announced Australian and Queensland government initiatives but not potential future actions. This allowed an informed and descriptive, rather than analytical assessment, and placing no emphasis on future dates resulted in positive responses to the assessment.

An important structural element of the report is the 'Key Messages', short statements that summarise the key findings of the report and allow the reader to quickly comprehend major points. The Key Messages formed the basis of the summaries for each assessment component, and during the development process, served as a basis for discussion with government agencies and the broader community (see Section 2.3).

Although the Act does not explicitly preclude recommendations, they were specifically excluded in this report, keeping the focus on the issues affecting the ecosystem rather than extending it to include future responses and responsibilities. This may have resulted in the report being more widely accepted by stakeholders.

### 2.2. Evidence

Identifying and collating the evidence for the Report evolved throughout the project as the GBRMPA's understanding of the information needs changed and as new information became available. A major strength of the Report was that it was based on the best available published and peer-reviewed science up to the end of 2008. In some cases, new information became available after that date and was included where it was considered to make a significant difference to a key finding of the Report. No new research was undertaken. However, because this was the first Outlook Report, the collation of evidence had to proceed in parallel with the development of the assessment structure, causing some inefficiency in gathering evidence (both evidence collected and not used and last minute collation of required evidence to inform the assessments).

The identified evidence was collated by the GBRMPA and an extract entered into an online information system (*Outlook Online*). From an early stage this information system was available to the Report writer(s), key scientists, the Outlook Reference Group (Section 2.3) and later to the peer-reviewers of the draft Report. By the end of the project, all of the evidence used to develop the Report was publicly available. *Outlook Online* is considered a very effective supporting resource for the Outlook Report because exact extracts (rather than references or links) are provided. Coordinated and rigorous updating of *Outlook Online* will efficiently provide the evidence base for future Reports and be a long-term resource for both the GBRMPA and wider community.

The separate consideration of each component in each assessment assisted with highlighting future information needs. The

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