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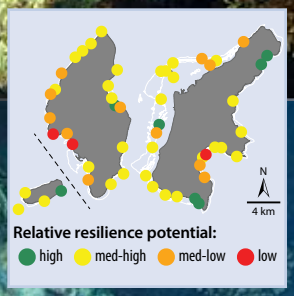
A Guide to Assessing **Coral Reef Resilience**

FOR DECISION SUPPORT



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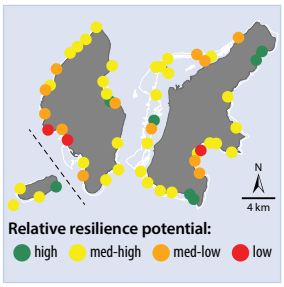

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Contents

Coral reefs are losing their resilience. These photos are of a reef near American Samoa in the south Pacific on December of 2014 (left) and then two months later (right). The photo on right is representative of the global-scale coral bleaching event that took place between 2014 and 2016. Photos: XL Catlin Seaview Survey.

Introduction

- *Coral reefs are naturally resilient*
- *Reefs are losing their resilience because of pressure from human activities combined with increasing climate impacts*
- *Resilience can readily be assessed*
- *Supporting resilience needs to be a management priority*
- *Local actions can influence the future resilience of reefs*

Coral reef resilience is the capacity of a reef to resist or recover from degradation and maintain provision of ecosystem goods and services (Mumby et al., 2007).

This resilience helps reefs to resist and recover after major disturbances such as severe tropical storms and mass bleaching events. Coral reefs are being exposed to these potentially devastating events with greater frequency, making resilience an increasingly important property.

Yet, through the cumulative impacts of human use and the activities associated with human settlements, coral reefs are losing their resilience. We are seeing the signs of this all around the world. Examples include regional declines in coral cover in the Caribbean (Jackson et al. 2014). and widespread conversion of fringing reefs to algal-covered rubble beds in many areas in the Pacific and Indian Oceans.

Maintaining and restoring resilience is now a major focus of most coral reef managers around the world.

A focus on resilience gives us options – and hope – in the face of new and often daunting challenges.

Underpinning this is the fact that local actions can positively influence the future of coral reefs, despite powerful external forces like climate change. As examples, coral recovery from disturbances in Bermuda and the Bahamas has been greater in recent decades than in other parts of the Caribbean. Differences in recovery rates in the Caribbean have been partially attributed to establishing and enforcing fishing regulations, especially on key herbivores such as parrotfish (Jackson et al. 2014). Overall though, the application of resilience theory to management planning and the day-to-day business of coral reef management has been challenging. One of the key stumbling blocks has been the lack of a robust and easily implementable method for assessing coral reef resilience in a way that can inform marine spatial planning and help to prioritize the implementation of management strategies.

Fortunately, our ability to assess relative resilience of coral reefs has advanced dramatically in recent years, and we are now at a point where a feasible and useful process can be recommended for use in environmental planning and management.

This guide is first and foremost intended for the individuals in charge of commissioning, planning, leading or coordinating a resilience assessment. It also provides a resource for 'reef managers' of all kinds, including decision-makers, environmental planners and managers in coral reef areas, with influence over pressures affecting coral reefs.

Outreach coordinators and educators working in coral reef areas may also benefit from the Guide, and they can participate in parts of the resilience assessment process, but the Guide focuses on the needs of decision-makers and the scientists who support them.

The guidance presented here represents the culmination of over a decade of experience and builds on ideas first presented by West and Salm (2003), Obura and Grimsditch (2009), and McClanahan and coauthors (2012). This Guide puts into managers' hands the means to assess, map and monitor coral reef resilience, and the means to identify and prioritize actions that support resilience in the face of climate change. Previously, resilience to climate change was rarely formally accounted for in marine spatial and conservation planning processes. We hope this Guide will help change that!

About this Guide

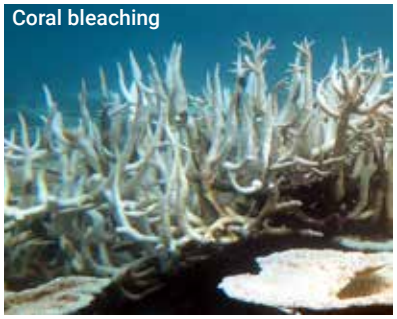
The introductory section familiarizes you with resilience and vulnerability concepts and reviews the various frameworks that are necessary to move from resilience theory to practical application. We help you define the decision-making contexts that can benefit from resilience assessments, and to clarify the objectives, scope and intended outcomes for your resilience assessment. A 10-step Guide is then presented for anyone who wishes to use the resilience assessment process to inform planning or management decisions. The guidance draws on practical experience in applying resilience concepts to coral reef management (see references to case study examples), and highlights both technical and process considerations for successful delivery of a resilience assessment project. We begin by reviewing the context for resilience assessments, followed by the considerations that can help you decide if resilience assessments are right for you.

The context for resilience assessments: Coral reefs in times of change

Coral reefs have persisted in various forms for hundreds of millions of years. Even today we can observe their amazing ability to resist and recover after devastating events such as hurricanes, crown-of-thorns seastar outbreaks and mass coral bleaching. Dramatic recovery of coral cover in places like .like Chagos Archipelago (Sheppard et al. 2013), Palau (Golbuu et al. 2007), and western Australia (Depczynski et al. 2013) are vivid illustrations of the importance of resilience when coral reefs are exposed to major disturbances.


Cyclone damage


Crown-of-thorns seastar outbreaks


Coral bleaching