Climate Change and the Great Barrier Reef

A Vulnerability Assessment

Edited by Johanna E Johnson and Paul A Marshall

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Foreword

The Great Barrier Reef is one of the truly majestic places on our planet. Its size and brilliance make is observable even from space. Few ocean areas are known as well globally as the 2,300 km of reefs that extend over the Australian east coast.

Comprised of more than 2,900 individual reefs that form its foundation, the Great Barrier Reef World Heritage Area encompasses a diversity of habitats, plants and animals of outstanding universal value. Scattered throughout its footprint are islands, mangroves and marine life of infinite variety. Like the Galapagos, the Great Barrier Reef has singular characteristics found nowhere else on Earth.

But, all of this is under threat as never before.

Global climate change is a virtual sword of Damocles hanging over the very heart of the Great Barrier Reef. History reveals that reefs have been faced with changes in the past, including fluctuations in water temperature, sea level and acidification. Climate change has accelerated this rate of change, coinciding with mounting pressure from human uses. These threats are certainly not unique to the Great Barrier Reef. Around the world, coral reefs are faced with impacts from poor water quality, overfishing, physical damage and climate change. Experts estimate that 20 percent of the world's coral reefs have been effectively destroyed and show no prospect of recovery, another 24 percent are under imminent risk of collapse through human pressures and 26 percent more are under longer-term threat. What makes the Great Barrier Reef unique is that, so far, it has remained in relatively good condition compared to other reefs around the world.

The timing of this book is critical. There is consensus amongst climate experts about the severity of climate change and its link to greenhouse gas emissions. We are now more certain about the amount of change that we can expect and its velocity. Take coral bleaching as an example. In 1998, we saw the world's first recorded global coral bleaching event. Many coral reefs were devastated by rises in sea temperature that exceeded the thresholds that can be tolerated by corals. Since then, worldwide coral reefs have continued to experience coral bleaching and the frequency and potentially irreversible impacts of these events is increasing.

Climate change poses an enormous danger and a new challenge for the protection of our natural heritage. What can marine managers do about changes that are worldwide in scope? We must start with understanding what the impacts on tropical marine ecosystems could be. Identifying the most sensitive species and habitats is an important outcome of this book. Identifying impacts that the ecosystem cannot tolerate is another. Efforts can then be targeted towards protecting these areas.

Unbiased experts are the key to finding solutions. This peer-reviewed book has been prepared by leading tropical marine and climate scientists. As we proceed down the inevitable path of climate change, the idea of change will and has become fundamental to understanding our environment and its role in shaping our ecosystems. Students today will emerge into a world of research and decision-making that did not exist for their predecessors. The authors of this book have provided the first text to assess the role of climate change on an ecosystem as large and diverse as the Great Barrier Reef.

As we experience climate change, we are starting to see real action to reduce greenhouse gas emissions. Governments and industries from around the world are accepting the reality of climate change and are building strategies to reduce their carbon footprint. These efforts must continue. We are committed to some change and we must prepare for it. But efforts to reduce greenhouse gas emissions and the extent of climate change is in our hands.

Based on solid facts, we must work together to find solutions. For without solutions, the Great Barrier Reef and all life is in peril.

Jean-Michel Cousteau
Founder and President, Ocean Futures Society

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Part IV: Enabling management

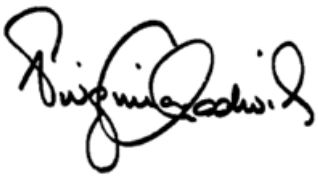
Preface

In many ways, the expert knowledge compiled in this book confirms what we already know: that the Great Barrier Reef is highly vulnerable to climate change. However, this unprecedented synthesis of current and emerging knowledge takes our understanding to a new level. In doing so, it increases our concern about the future but also gives us cause for optimism.

We now have a much deeper understanding about the extent and range of climate sensitivities that exist within the GBR ecosystem and, significantly, about the gaps in our knowledge. This heightened awareness increases our concern about the fate of corals – which build and maintain the foundations of the GBR – while also bringing into focus the vulnerabilities of many other components of the ecosystem. Although the size of the GBR and the effective long-term management regime afford it some protection from climate change compared to other tropical marine ecosystems, this assessment makes it clear that further degradation is unavoidable. However, there is much scope for minimising the negative impacts of climate change, and for avoiding the worst of their consequences.

The new opportunities for meaningful responses to climate change provide the basis for our optimism. This assessment identifies specific strategies for reducing the vulnerability of particularly sensitive species and habitats, while also refining our knowledge about ways to further restore and maintain the resilience of the ecosystem. While reductions in the rate and extent of climate change remain the single most important goal if we are to improve the prognosis for tropical marine ecosystems, actions to build the resilience of the GBR will be instrumental in averting what leading scientists have called the "coral reef crisis". Effective management of the GBR has never been more important.

This assessment was commissioned by the Great Barrier Reef Marine Park Authority, in partnership with the Australian Greenhouse Office, to comprehensively assess current knowledge about climate change vulnerability, and to identify strategies for building resilience. These insights provide the foundations for the GBR Climate Change Action Plan, which will help GBRMPA and its partners navigate toward a healthy GBR that is more resilient to climate change. We hope that it will be of value to our international colleagues who share the responsibility of protecting tropical marine ecosystems for their beauty, their productivity, and for future generations.



Hon Virginia Chadwick
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