



**Australian Government**

**Great Barrier Reef  
Marine Park Authority**

# Science and Knowledge Needs for Management



# Foreword



The Great Barrier Reef is an inherently complex social-ecological system. Biological, physical and social aspects are intertwined across spatial and temporal scales. A legacy of human-use impacts on the Reef, compounded by increasing climate change-related threats, has led to substantial shifts in the system. As the lead management agency for the Reef, we must focus on solutions to protect and restore values at local and regional scales. Our management actions must be optimised to ensure they lead to desired future outcomes. This is why our priority science and knowledge needs have a focus on elements that will help improve our management and protection strategies over the long term. We use high quality science and deploy innovative solutions to deliver world-leading management of the Great Barrier Reef.

We cannot do this alone. We value the strong partnerships we have with our Commonwealth science partners

– the Australian Institute of Marine Science, CSIRO, and the Bureau of Meteorology. We also value our partnerships with research providers, across government, with Traditional Owners, and the diverse network of natural resource managers, and community and industry science providers. Ongoing development of the Reef 2050 Integrated Monitoring and Reporting Program (RIMReP) will bring together information to provide an interactive Reef-health picture and inform future management, and identify data needs. This document provides an overview of the Authority's priority science and knowledge needs. Science and knowledge is critical to the management of the Great Barrier Reef and emphasises the importance of working in partnership to achieve management outcomes.

**Josh Thomas**  
Chief Executive Officer  
Great Barrier Reef  
Marine Park Authority

*The Great Barrier Reef Marine Park Authority acknowledges the remarkable worldviews, unique wisdom and enduring connections that have informed the guardianship of the Reef for millennia. We pay our respects to the Traditional Owners as the first scientists of this land and sea, and value their traditional knowledge which continues to inform the current management and stewardship of the Reef for future generations.*

Graphical elements taken from *Step of Change* by Nicky Bidju Pryor – Bidju Designs Commissioned for the Great Barrier Reef Marine Park Authority's Reflect Reconciliation Action Plan 2018

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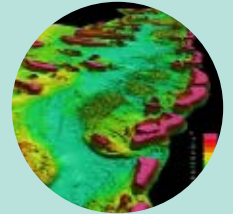


# History of science on the Reef

For tens of thousands of years, Aboriginal and Torres Strait Islander peoples were employing scientific methods, such as observation and experimentation. The modern Great Barrier Reef (the Reef) formed over 7000 years ago, coinciding with the last sea level rise. Since European settlement, there has been rapid growth in human use of the Reef, particularly in the 20th century, with technological advances in boating, fishing, and scuba diving. During the 1970s and 80s, the Reef became an international icon, a global epicentre for coral reef science. By 2021, the legacy of human use impacts on the Reef is being compounded by the increasing threats associated with climate change, evidenced by several mass coral bleaching events in the past decade.



**>60,000 years ago**  
First scientists - Aboriginal and Torres Strait Islander people's land & sea country connections



**7000 years ago**  
Modern Great Barrier Reef formed

**1893**  
William Saville Kent publishes "The Great Barrier Reef of Australia: its products and potentialities"

**1922**  
The Australian Coral Reef Society founded (called The Great Barrier Reef Committee)

**1930s**  
Increase in tourism, commercial and recreational fishing

**1928**  
Sir Charles Maurice Yonge led the Low Isles Expedition



**1942**  
Invention of SCUBA



**1951**  
The first research station on the Reef established on Heron Island

**1962**  
First documented outbreak of crown-of-thorns starfish



**1967**  
'Save the Reef' campaign protected Ellison Reef from mining

**1972**  
Australian Institute of Marine Science (AIMS) established



**1975**  
Great Barrier Reef Marine Park Authority established

**1983**  
Great Barrier Reef Long-term Monitoring Program began (est AIMS)

**1998**  
"State of the Great Barrier Reef World Heritage Area Report" published



**2003**  
Traditional Use of Marine Resource Agreements (TUMRAs) developed by Traditional Owners

**2003**  
Revised Zoning Plan increased the percentage of no-take areas in the Marine Park to 33 per cent



**2009**  
First five-yearly "Great Barrier Reef Outlook Report" published

**2016, 2017 & 2020**  
Mass coral bleaching events



# Our approach

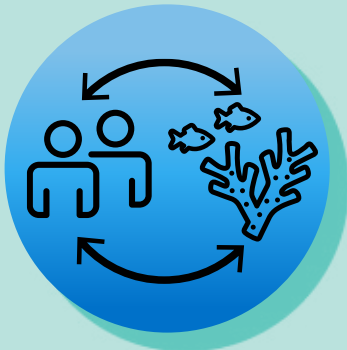
The Great Barrier Reef Marine Park Authority (the Authority) has been providing world-leading marine park management since 1975. We are entrusted by Australia with the responsibility of managing the global icon that is the Great Barrier Reef (the Reef). We rely upon the best available science and partnerships to protect the Reef and its values, reduce threats, and improve the outlook for the Reef and the communities that depend upon it.

In addition to our direct management role, we also provide expert knowledge and advice to government, science partners and users of the Marine Park through policy development, communication, education and engagement. We base this advice on an evaluation of relevant scientific publications, which can also be complemented by other knowledge sources, perspectives and lived experience. An example is the Great Barrier Reef Outlook Report (2009, 2014 and 2019), the most recent edition of which referenced more than 1400 scientific journal articles, reports and data sets. The Authority also brokers science partnerships and the exchange of science and knowledge between government, Traditional Owners, scientists, industry, and the community.

The Authority rarely relies on a single scientific paper as the sole basis for investment and action. Instead, the accumulated knowledge from multiple lines of evidence, scrutinised by peer review and in some cases, independent panels of experts, informs our decision making. The Authority supports measures that increase data accessibility, scientific rigour and two-way knowledge sharing.

## Key elements of our science for management approach

### Social-ecological systems



The Reef ecosystem and the people that use it are strongly interconnected. To ensure a long-term future for the Reef, management focuses on both social and ecological processes and outcomes. A social-ecological systems approach is one that involves management actions that consider ecological, social, and economic factors, while noting the precautionary principle.

### Multiple lines of evidence



The Authority collates and considers evidence from a wide range of scientific sources and knowledge providers, and values the essential role of the peer review process. This approach supports rigorous, comprehensive, risk-based decision making.

### Incorporating Traditional knowledge



Aboriginal and Torres Strait Islander peoples have cared for their sea country and heritage for tens of thousands of years, and have a wealth of knowledge specific to the Reef. Integrating Traditional Owner knowledge with community and industry knowledge, provides a much better understanding of the current health of the Reef and how it has changed over time.

Use of the **precautionary principle** is a legislative requirement under the *Great Barrier Reef Marine Park Act 1975*. Science underpins this principle. The precautionary principle states that a lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage. This is a key element of ensuring ecologically sustainable use.

# Priority science and knowledge needs

This document sets out the Authority's four overarching science and knowledge themes and associated priority information needs. These priority needs will form the focus of collaboration opportunities with science and knowledge providers, and are informed by the Great Barrier Reef Outlook Report 2019, the Reef 2050 Plan and emerging needs identified by Authority staff. To explore project level opportunities based on our priority needs, please visit the Reef Knowledge System (<https://reefiq.gbrmpa.gov.au/ReefKnowledgeSystem/Reef-tools/science-and-knowledge-needs>)

## What is the condition and trend of key\* values?

Re-evaluate indicators necessary to measure social values and ecosystem health under different scenarios

Condition and trend data for key\* species and habitats, heritage, social, cultural, and economic values

Identification of critical thresholds and tipping points for ecosystem health to inform reporting and response

Distribution, population demography and dynamics of commercially important species and species of conservation concern

Quantifying the impact of non-compliance with zoning rules and the ecological and social flow-on effects



## How can we optimise our management impact?

Determine if spatial planning restrictions are achieving the desired outcomes (e.g. sensitive seabird sites, no anchoring areas)

Supporting the integration of Traditional knowledge and the knowledge of Reef-dependent industries into Reef management decision making

Evaluating and optimising the effectiveness of intervention, remediation and restoration efforts

Measuring the social-ecological system outcomes achieved through spatial planning arrangements, intervention, remediation and restoration



## Key knowledge and science themes

## How is the Reef used?

Contemporary spatial understanding of human use within the Marine Park at sub-regional scales

Comparative analysis of how human-use patterns have changed over time and understanding drivers of change

Evaluating and optimising ecologically sustainable use of the Reef (e.g. tourism, recreational and commercial fishing), while maintaining socioeconomic benefits

Measuring the social-ecological system outcomes of stewardship actions



## How can we improve our management through innovation and technology?

Development of remote and real-time technologies to assist with monitoring, surveillance and compliance automation

Integration of data (RIMReP) to drive innovative management solutions to emerging pressures and high risk threats

Development of predictive models to improve management responses to acute and chronic threats

Development of fit-for-purpose decision-support tools and systems that help optimise the social-ecological outcomes of Marine Park management

Development of social innovations to shift attitudes and behaviors



### \*Priority key values include:

species that are protected by law at an international, national, state or local level; species classified as either threatened, iconic or at risk in the Great Barrier Reef; commercially/ecologically important species that are in decline or vulnerable to decline; habitats and ecosystem processes that are critical to vulnerable, declining, or commercially/ecologically important species; and heritage values for which there is limited evidence, such as Indigenous heritage values.

# How to collaborate with us

The Reef is one of the most well researched and monitored ecosystems in the world. This is due to sustained investment in science and long-term partnerships with dedicated and committed research providers. These efforts are enhanced by ongoing involvement of industry (including tourism, commercial fishing, and ports), Traditional Owners, and a growing community contribution through citizen science programs, particularly the Authority's Eye on the Reef program.



The Authority is focussed on brokering the exchange of knowledge between science providers and those that will use and act on the findings – including government, Traditional Owners, industry, or the community. The Authority's preferred approach to harnessing science and knowledge for evidence-based policy, programs and decisions is based on co-design, co-production and sharing of knowledge. Ideally this is a two-way exchange between the Authority and providers at the initiation stage, and if appropriate, throughout the design, collection, application and production process.

## Benefits of collaborating with the Authority:

- Maximise and demonstrate direct application of science and knowledge into decision making processes
- Broader communication and promotion of your work through government and partners
- Opportunities to strengthen co-management and information exchange with Traditional Owners
- Opportunities for support (in-principle, in-kind and/or financial)
- Opportunities to discuss research design in advance to understand permission requirements and timeframes
- A productive and better managed Reef

### Collaborate early

Shared understanding of science priorities

Relevant partners, Traditional Owners, and stakeholders are identified

Co-development of research questions where relevant

Reef managers can consider future application of project outcomes to management

Identify pathways to impact together

### Communicate often

Existing information and knowledge is leveraged rather than duplicated

Awareness of emerging needs and issues

Identify and broker additional partnerships and support for your project

Proactively share information and stay connected

Work together on projects

### Deliver impact together

Collective communication and promotion of findings

Data, information, and knowledge is discoverable, accessible, understandable and useable

Findings can be incorporated and applied to decision making

Ongoing partnerships forged to maximise the effectiveness of uptake and outcomes

Future partnerships more likely

For more information on collaborating with the Authority, contact our science team at [science@gbmpa.gov.au](mailto:science@gbmpa.gov.au)



# What we collaborate on

We coordinate and collaborate on a number of research and monitoring programs, some of which include:

## The Great Barrier Reef Marine Monitoring Program



This is a collaborative partnership between the Authority, Reef Joint Field Management Program, AIMS, James Cook University, and others. Monitoring of inshore water quality, coral, and seagrass provides understanding of the risks to the Reef from sediments, nutrients, and pesticides in catchment run-off and how extreme weather affects Reef resilience.

## Technology Transformation Program



This is an initiative of the Reef Joint Field Management Program which aims to collaborate with research institutions and other government agencies to investigate, trial, and implement new technologies that will improve compliance, monitoring capability, efficiency and staff safety.

## Crown-of-thorns Control Program



Collaboration between Marine Park managers, research partners, COTS Control Program vessel operators, and the tourism industry, has facilitated an informed and adaptive approach to COTS management that effectively protects coral on ecologically and economically valuable reefs throughout the Marine Parks.

## Working with Traditional Owners



The [Aboriginal and Torres Strait Islander Heritage Strategy for the Great Barrier Reef Marine Park](#) sets out how the Authority will work with Traditional Owners to keep Indigenous heritage strong, safe and healthy. Projects will incorporate Traditional Owner knowledge and expertise into management decisions, such as enhancing the TUMRA program and Traditional Owner-estate specific Permissions Assessment Guidelines.

# Citizen science and the Reef

Citizen science is community participation and collaboration in scientific research. The Eye on the Reef program is the Authority's citizen science platform, enabling Reef visitors to be citizen scientists by contributing valuable information to management about reef health, wildlife and incidents.

Partnerships between scientists and the community can have multiple benefits, including strengthening research capacity and efficacy, providing community education and providing opportunities for community and industry stewardship.

Recognised forms of citizen science partnership include:

- **Contributory** - citizens collect or process data for scientists
- **Collaborative** - citizens engage in work beyond data collection or processing, such as project design, analysis or communication
- **Co-created** - citizens and scientists work together in all aspects of the scientific process

It is not the Authority's position to endorse external citizen science programs. Rather, we encourage Reef citizen science programs to adhere to the 10 Principles of Citizen Science (<https://eu-citizen.science/about/>) developed by the 'Sharing best practice and building capacity' working group of the European Citizen Science Association and adopted by the Queensland government.



For more information on the Authority's Eye on the Reef program, contact us at [eyeonthereef@gbmpa.gov.au](mailto:eyeonthereef@gbmpa.gov.au).

See the Reef  
Love the Reef  
Protect the Reef



*“More than ever before, use of the Great Barrier Reef Region must be sustainable and effectively managed. To protect and restore habitats, species and heritage values, our management must complement proven techniques with innovative approaches that are targeted, science-based and risk-managed.”*

*– Dr. Ian Poiner, Chairperson, Great Barrier Reef Marine Park Authority*



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