



Australian Government
Great Barrier Reef
Marine Park Authority



Reef
Authority

Great Barrier Reef Outlook Report 2024



In Brief



Great Barrier Reef Outlook Report 2024

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Preface

The Great Barrier Reef Outlook Report is required to be published every five years in accordance with the *Great Barrier Reef Marine Park Act 1975*. It provides an evidence-based overview of the Reef's current condition, use, factors influencing the condition, management effectiveness, resilience, risks to its future and likely outlook. The contents of the Outlook Report were independently peer reviewed. This *Great Barrier Reef Outlook Report 2024 — In Brief* presents a summary of the key findings from the topics and chapters in the main report.

The legislation requires that an Outlook Report be prepared every five years. As in Outlook Report 2009, 2014 and 2019, this report identifies that the Great Barrier Reef Region faces significant pressures ranging in scale from local to global. Climate change remains the greatest threat to the Great Barrier Reef.

The Great Barrier Reef retains its outstanding universal value as a World Heritage Area. While its natural beauty and phenomena endures, its integrity is being increasingly challenged. Cumulative pressures, predominantly from climate change, combined with the time required for the recovery of key habitats, species and ecosystem processes continue to affect the overall health of the Great Barrier Reef. Recent recovery in some ecosystem values demonstrates that the Reef is still resilient, but its capacity to tolerate and recover is jeopardised by a rapidly changing climate, with implications for Traditional Owners, Reef-dependent communities and industries.

The arrival of El Niño climate conditions in mid-2023 highlighted the narrowing of critical recovery windows for the Reef's health. It brought record global temperatures on land and in the oceans and, by the end of summer 2023-24, the now-familiar sight of mass coral bleaching. The full impacts of this latest mass coral bleaching event are still being determined.

Even with the recent management initiatives to reduce threats and improve resilience, the overall future outlook for the Great Barrier Reef is very poor. These findings will be best addressed through urgent national and global action to deliver on international commitments that would limit temperatures to 1.5°C of warming—or as close as possible. Across the Region and at local scales, it is imperative that everything possible is done to create recovery windows for the Reef. Improving water quality and enhancing on-ground management actions are critical to addressing compounding threats and supporting Reef resilience.

Yours sincerely



Ian Poiner
Chair
Great Barrier Reef Marine Park Authority

Executive summary

of the Great Barrier Reef Outlook Report 2024

The following is the complete text of the Executive Summary of the Great Barrier Reef Outlook Report 2024

The window of opportunity to secure a positive future for the Great Barrier Reef (the Reef) is closing rapidly. The Reef remains a vast and spectacular ecosystem and one of the most complex natural systems on Earth. Recognised for its outstanding universal value as a World-Heritage-listed property, it transcends national boundaries and is a source of pride for the Australian public. It supports the livelihoods and wellbeing of its Traditional Owners and coastal communities by providing material, spiritual and cultural sustenance and drawing visitors from across the world. It delivers ecosystem services that support the economic prosperity of tourism, fishing and other industries that depend on the Reef.

A wealth of habitats, species and genetic riches underlie the Reef's resilience, and — thanks to decades of effective protection and management — its natural beauty and natural phenomena endure. Nevertheless, the ratcheting pressures brought about by climate change, combined with chronic and legacy impacts, are undermining the Reef's resilience. The Region's overall long-term outlook remains one of continued deterioration due largely to climate change.

Urgent action to deliver on international commitments that would limit temperatures to 1.5°C of warming— or as close as possible—remains critical. This would deliver the best possible future for the Reef and the livelihoods that depend on it. But global action is currently falling short of what is needed. New ways of thinking are needed to complement existing management in charting a positive path forward for the Reef and its dependent communities.

The Great Barrier Reef Outlook Report 2024 has been prepared by the Great Barrier Reef Marine Park Authority based on the best available information. Prepared every 5 years, Outlook Reports provides a summary of the long-term outlook for the Reef based on its condition, use, influencing factors, management effectiveness, resilience and risks. It fulfils the requirements of Section 54 of the *Great Barrier Reef Marine Park Act 1975* (Cth). The reporting period generally includes data from January 2019 to December 2023 and, where possible, compares it with historical trends.

2024 opens a new chapter for the Reef. Future warming already locked into the climate system means that further degradation is inevitable. This is the sobering calculus of climate change. Every increment of additional global warming will further compromise the Reef's unique biodiversity, with continuing consequences for cultural heritage, social and economic benefits, and the broader ecosystem services of the Reef.

Over the past 5 years, the condition of natural values of the Great Barrier Reef Region (the Region), including species, habitats and ecosystem processes has varied, with both improvements and deteriorations documented. Overall, the condition of habitats remains poor on a Region-wide scale, in large part due to the ongoing vulnerability of coral reef habitats.

Despite widespread coral bleaching in 2020 and 2022, the absence of mass mortality from the bleaching — along with relatively little cyclone damage and effective management of crown-of-thorns starfish — allowed for recovery of fast-growing corals across much of the Region. This resulted in an improved overall condition of coral reef habitats from very poor to poor (borderline good), but this varies across the Reef. The condition of seagrass meadows has also improved since 2019 to good (borderline poor) condition, reflecting the recovery from past flooding impacts in some areas. Other habitats remain in good or very good condition.

Improvements in the condition of some species did occur in the reporting period (2019 – 2023). Widespread recovery of corals, typically by a few fast-growing species, led to an improved condition for this group from very poor to poor. Populations of estuarine crocodiles have also continued to recover. Species such as seabirds, sharks and rays, dugongs, and seagrasses, have recovered in some areas while some populations have plateaued or declined in others. Most populations of marine turtles have declined. Many of the species showing declines are listed as threatened or protected species under various State and Commonwealth legislation.

The Region relies upon the healthy functioning of a range of physical, chemical and ecological processes, and connection to functioning coastal ecosystems. The conditions of most processes are similar to those reported in 2019, with continued deterioration of several key processes influenced by climate change and land-based runoff.

While recent recovery in some ecosystem values demonstrates that the Reef is still resilient, its capacity to tolerate and recover is jeopardised by a rapidly changing climate. Outlook Report 2024 reports on the past five years to December 2023. The subsequent events of early 2024 provide a stark illustration of warnings articulated since the first Outlook Report was released in 2009. The arrival of El Niño climate conditions in mid-2023 brought record global temperatures on land and in the oceans and, by the end of summer 2023 — 24, the now-familiar sight of mass coral bleaching. Although the full impacts of this latest mass coral bleaching event are still being determined, the event highlights the narrowing of critical recovery windows for the Reef's health.

Many of the Region's heritage values, particularly Indigenous heritage, are inseparable from the condition of the ecosystem and are vulnerable to the same threats. The living heritage of First Nations people across the Region remains resilient. Agency and access by First Nations people to manage their Country is fundamental to the condition of ecosystem and heritage values. Strengthening Traditional Owner involvement in the management of Sea Country is vital. Managing agencies can continue to build an enabling environment for Traditional Owners to protect Land and Sea Country through implementation of co-management principles. The Reef 2050 Traditional Owner Implementation Plan is a critical part of this pathway forward. Other heritage values, including social, aesthetic and scientific, are considered in good condition overall. While the property's outstanding universal value as a World Heritage Area remains whole and intact, its integrity continues to be challenged.

The Reef ecosystem, the people who use and depend on it, and human wellbeing are deeply interconnected. Understanding the relationships and feedback loops between the Reef's ecological and social systems is crucial. As the Reef changes, it will pose unprecedented challenges to dependent communities and industries, and require changes in the way people interact with, and derive benefit from, the Reef. The Reef remains a significant economic resource for industry, regional Queensland communities and Australia. The COVID-19 pandemic affected most Reef-dependent industries due to national and international border closures and impacts to market chains. Tourism visitation was greatly reduced during this time but is starting to recover. Reductions in international trade and exports affected the commercial fishing, shipping and port industries. In contrast, recreational use of the Region is understood to have increased.

The Region is influenced by activities occurring within and adjacent to the Region and is protected and managed by a partnership between many government agencies, Traditional Owners, stakeholders and community members. Effective management of the Region is a complex task given the range of threats and their variation across space and time. An independent review found the Region continues to be well managed, with the *Reef 2050 Long-term Sustainability Plan* improving jurisdictional consistency, coordination and resourcing. Direct use of the Region is also generally well managed reflecting, in part, the maturity of many management systems. Management of the Reef's values in relation to climate change and coastal development remains subject to significant challenges.

Climate driven disturbances are compounding the cumulative effects of chronic impacts (such as unsustainable fishing, pollution and sedimentation), acute disturbances (such as cyclones), and outbreaks of crown-of-thorns starfish. Building on efforts to reduce greenhouse gas emissions, management actions need to continue to address compounding threats and support the Reef's natural resilience. Actions must capitalise on recovery windows and maximise the Reef's inherent capacity for regeneration and change.

It is vital to identify and protect places (including climate refugia), habitats, species and ecosystem processes that are critical for resilience. Well-targeted culling of crown-of-thorns starfish can promote resilience in coral reef habitats by preventing severe coral losses from predation and protecting the supply of juvenile corals to damaged reefs. Multi-agency efforts to explore tangible and scalable reef interventions may lead to a suite of other innovative and targeted measures that could provide options for management in future.

Meeting water quality improvement targets is a crucial step towards a more resilient Reef. Poor water quality continues to affect many coastal and inshore areas of the Reef. Since 2019, water quality has continued to

improve slowly reflecting modest improvements in agricultural land management practices and land-based runoff.

Sustainable fisheries and healthy fish populations are critical to maintaining a healthy ecosystem and a functioning Reef. Ongoing reform under the *Queensland Sustainable Fisheries Strategy 2017-2027* has led to important improvements in fisheries management. Notably, the incidental catch of species of conservation concern is likely to go down due to implementation of the planned phase-out of gillnets in the Reef by 2027. However, fishing activities continue to have a high impact on the Region's values. Some stocks, such as saucer scallops and Spanish mackerel, remain depleted and outcomes from fisheries reforms are yet to be fully realised. Key gaps in understanding relate to recreational fishing, discarded catch and bycatch, and independent validation of fishing data.

A vigilant, proactive and optimistic approach to management remains crucial. The Reef may be forever changed, but it has various possible futures. Choices made today can lead to vastly different outcomes — the path that unfolds will be shaped by the actions of many.



Difficult choices and trade-offs will need to be met head on and more often. Managers must take a clear-eyed approach, making decisions in the face of uncertainty and responsibly evaluating outcomes. Decisions should be based on the best available evidence, apply a risk-based approach, and acknowledge the realities of a changing Reef. Effective decision making depends on decision support tools that leverage emerging technologies and incorporate monitoring data, outputs from models, cultural science, and field intelligence.

Strong and effective actions are urgent at global, regional and local scales. Broad, multijurisdictional management actions that involve the community and behaviour change will be important in maintaining resilience of social heritage values. The health of the Reef ecosystem will continue to have both impacts on, and benefits for, the community and human wellbeing. Society will need to play a pivotal and urgent role in mitigation and adaptation to support the Region's resilience.

The Great Barrier Reef is one of the best managed reef systems in the world. While coral reefs across the globe are facing urgent and present threats from a warming climate, the Reef's diversity of habitats, species and genetic riches uniquely position it to retain resilience in the face of change. The future Reef will be altered by climatic changes already in motion, but just as every increment of warming compounds impacts, every effective action taken now contributes to a more positive long-term outlook.

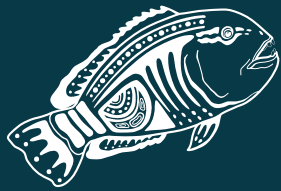
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 Trend since 2019
  Future trend

Assessments within the Outlook Report 2024

Figure 1.3 in main report: Each of the assessments required under the Act and relevant regulations forms a chapter of the report. The assessments relate to the condition of the Region's ecosystem and its heritage value and examine threats, responses and risks. These then inform an assessment of the likely outlook for the Region's values.



1. About this Report

“One of my main reasons for working on Country is I reckon my grandmother would be very proud. She fought for the land for a very long time and I want to make sure I keep doing the same in my way. Hopefully, by doing this work I can keep the bloodline on Country and to learn the new and old ways.”

— Stirling King, GMY Traditional Owner and Indigenous Ranger with the GMY Land and Sea Ranger program

The Gunggandji-Mandingalbay Yidinji Land and Sea Rangers (GMY Rangers) group is shaping up to be an accomplished and highly qualified team of Indigenous rangers — caring for their Sea and Land Country, in dual World Heritage Areas in Yarrabah, near Cairns in Far North Queensland.

Source: Caring for Sea Country — Traditional Owner Stories from the Great Barrier Reef ¹

The Great Barrier Reef Marine Park Authority (the Reef Authority) prepares an Outlook Report for the Great Barrier Reef Region every five years. The *Great Barrier Reef Marine Park Act 1975* (Cth) (the Act) and the regulations applying to the Great Barrier Reef Marine Park (the Marine Park) specify what the report must contain and the relevant statutory timeframes.

The Outlook Report underpins decision making for the long-term protection of the Great Barrier Reef (the Reef). Its purpose is to provide an accountable and transparent assessment of the overall performance of measures to protect and manage the Reef, using the best available evidence.

The report provides a summary of the long-term outlook for the Reef based on assessments of condition, use, influencing factors, management effectiveness, resilience and risks. The Outlook Report does not include recommendations about future protection or management initiatives. Rather, it provides an evidence-based assessment that can be used to inform future protection and management initiatives.

The Outlook Report is a key input to Reef management, the review of the Reef 2050 Long-Term Sustainability Plan (Reef 2050 Plan), and reviews of zoning plans. It also plays a significant role in informing Australia's reports to the World Heritage Committee addressing the state of conservation of the Great Barrier Reef World Heritage Area.

The Outlook Report 2024 builds upon previous reporting from the first three Outlook Reports, released in 2009, 2014 and 2019. While much of the 2024 report's assessment focuses on retrospective performance over the five-year reporting period (2019 to 2023), a forward-looking long-term outlook is also provided in Chapter 10.

The jurisdictional scope of the report covers the entire Great Barrier Reef Region (the Region). The Commonwealth has jurisdiction over most of the Region which covers approximately 346,000 square kilometres, from the tip of Cape York in the north to past Lady Elliott Island in the south. The Torres Strait is not part of the Region. The boundary extends seawards from mean low water to the eastern border with the Coral Sea Marine Park, a distance of between 70 and 250 kilometres from the mainland coast. About 70 Commonwealth islands are included within the boundary. However, the majority of islands in the Great Barrier Reef (approximately 980 islands) are under jurisdiction of the State of Queensland and therefore, not included formally within the Region. Where it is relevant to the health of, or factors influencing, the Reef ecosystem and its heritage values, the report looks beyond the Region's jurisdictional boundaries and includes information about adjacent islands, neighbouring marine areas and the Great Barrier Reef river catchments (the Catchment).



The Reef is a complex social-ecological system, where the natural ecosystem and the people who use it are strongly interconnected. First Nations peoples view health of the environment and health of people as inextricably linked — healthy Country means healthy people. The critical role that ecosystems play in underpinning many constituents of human wellbeing is considered in various chapters throughout the report.

The report is structured around the nine assessments required by the Act and its regulations, with each assessment forming a chapter of the Report. Early chapters focus on the current condition of the values of the Reef and trends in condition to date. Future trends in the condition of the values depend on the drivers influencing them, which are discussed in later chapters.

Assessments use a four-point grading scale, which has been used since 2009 and is continued for consistency. The grade allocated is a 'grade of best fit', based on a qualitative assessment of the available evidence from existing research and information, with a focus on sources from the past 5 years. 'Outlook In Brief' presents the grades for each chapter's assessment criteria. More detailed information, including grades for the components within the criteria, can be found in the full report.

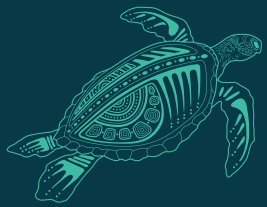
The Outlook Report has been prepared by the Reef Authority, with contributions of evidence from a number of Australian and Queensland government agencies, researchers from a range of institutions, industry data-holders and Traditional Owners.



Marine Parks vessel in the Region amongst other users. © Commonwealth of Australia (Reef Authority), photographer: Johnny Gaskell 2021

The perspectives and knowledge of First Nations peoples have been incorporated through co-produced place-based stories, participation in workshops and, where available, published literature and reports. The outcomes of an expert elicitation workshop involving more than 45 scientists, Traditional Owners and other stakeholders contributed to the assessments of biodiversity, ecosystem health and heritage value and informed the forward-looking risk and resilience assessments. Five independent assessors in protected area management, monitoring and evaluation, public policy and governance reviewed the effectiveness of existing protection and management arrangements for the Region's ecosystem, its heritage value and, where relevant, the Catchment. The assessors' reports form the basis of the assessment of existing measures to protect and manage the Region.

Five experts, appointed by the Australian Minister for the Environment and Water, independently reviewed the draft Outlook Report. Their comments were considered and incorporated into the final report.



2. Biodiversity

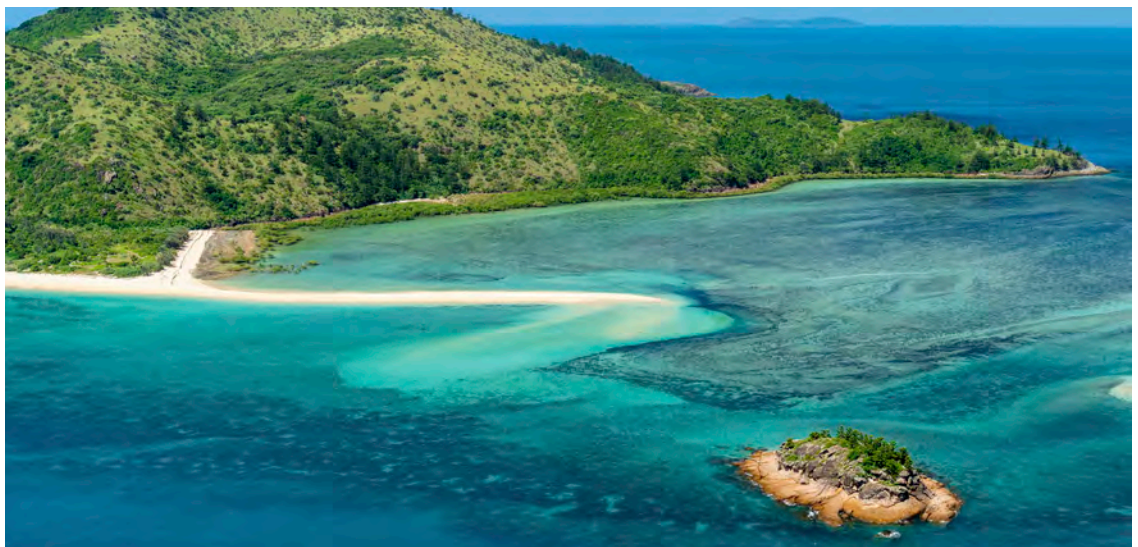
“We want seagrass healthy for our next generation, as a main food supply. And it would be good to see turtles and dugongs, stingrays coming back in more numbers. With turtles and dugongs, you don’t realise how much they need seagrass, the seagrass environment is changing, the wet and dry seasons are changing. We can’t rely on the old ways as much as we used to because of how climate is not following its normal habits”

— Stirling King, GMY Traditional Owner and Indigenous Ranger with the GMY Land and Sea Ranger program
Source: Caring for Sea Country — Traditional Owner Stories from the Great Barrier Reef¹

The Great Barrier Reef is the largest coral reef ecosystem in the world and remains one of the world’s most diverse and remarkable ecosystems. The biodiversity of the Reef underpins its rich and complex ecosystem, conferring a range of benefits to the Reef itself and to the industries and communities that depend on it for their livelihoods and wellbeing.

Biodiversity is critical to Traditional Owners of the Reef, to the outstanding universal value of the world heritage property and is a fundamental component of ecosystem resilience. Despite its importance and the wealth of information available for some species and habitats, knowledge of much of the biodiversity on the Reef remains limited. Rapid advances in technologies are helping to shed light on some of the Reef’s lesser-known habitats and species.

Within the Region, legacy human-use impacts, such as historical land clearing, coastal development and overfishing, have substantially altered habitats and species in the past and continue to have major effects today. Climate change has already contributed to the suite of legacy impacts on the Region, altering the structure and functions of ecosystems and their species composition.



Cockermouth Island near Mackay. © Mark Fitz 2023

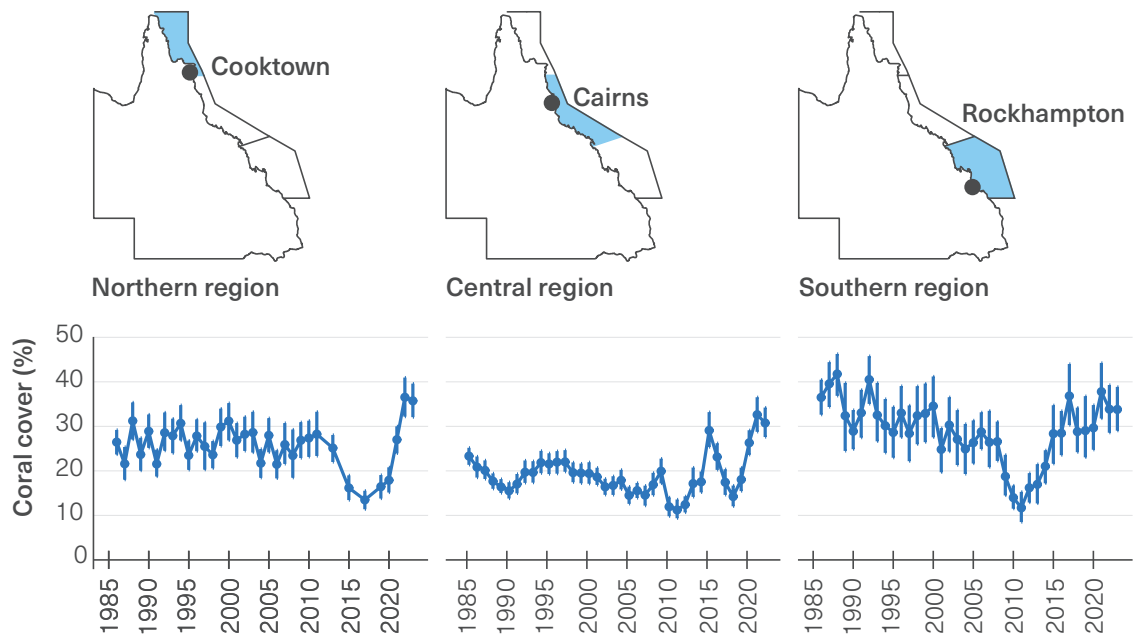
Shifting environmental baselines can occur when, as generations pass, there is a perception that the current or recent past condition of habitats or species represents a natural state despite progressive degradation. This is especially the case where historical or anecdotal information is not effectively considered. Assessments in this chapter consider the available evidence for each habitat and species component, including recent information and historical trends where available.



The overall condition of the Region’s biodiversity considers the condition of its habitats, species and the interconnections between them. Grades provided are for the entire Region for all habitats and species. In addition, for the first time in Outlook reporting, the condition of coral reef habitats is also assessed at a regional scale to provide some insight on variation between the northern, central and southern regions. Across all regions, considerable variability exists between inshore and offshore areas and within and between individual reefs. The Outlook Report 2024 reports on the past five years to December 2023. In some parts of the Region, summer 2023–24 brought multiple stress events, the effects of which are not yet known.

The condition of **habitats to support species**, remains poor overall, reflecting that habitat loss and degradation in a number of areas continues to have significant effects on populations of some dependent species. However, the overall trend since 2019 has improved.

Coral reef habitats within the Region are assessed to be in poor (borderline good) condition — an improvement since 2019. Between 2019 and 2023, natural recovery led by fast-growing corals has driven rapid increases in coral cover across the Region overall, although recovery has been slow at some sites and other measures of coral condition are less well understood. The culling of crown of thorns starfish has facilitated recovery at many locations. Nevertheless, significant and large-scale impacts on coral reef habitats continue to be observed, primarily as a result of climate-related ocean warming. Coral reefs remain highly vulnerable to climate change, crown-of-thorns outbreaks and poor water quality in inshore areas. (The full extent and impact of the 2023-24 summer cyclones and mass coral bleaching event is not known at time of writing and is not considered in this assessment).

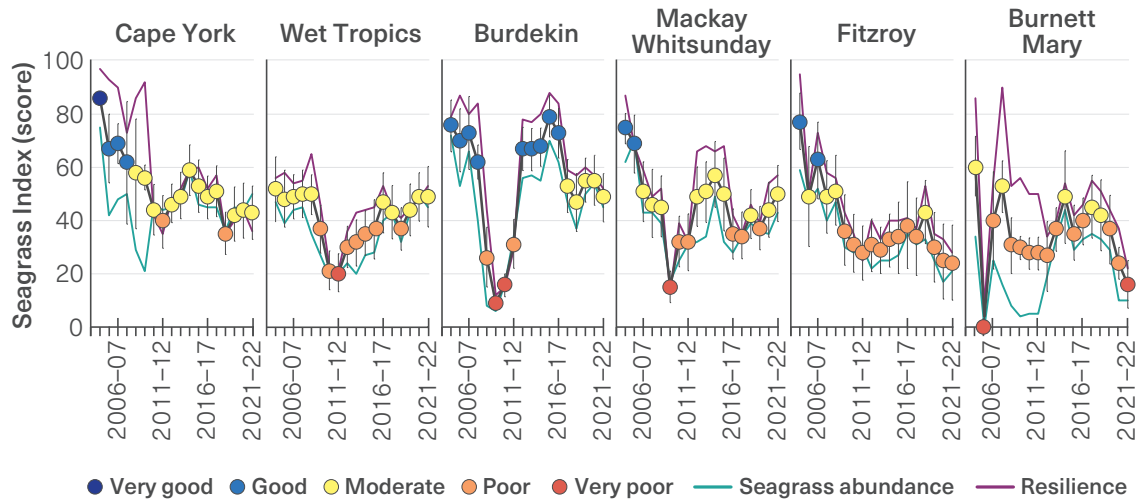


Trends in mean hard coral cover since 1986 for the northern, central and southern Reef.

Figure 2.5 in main report: Mean hard coral cover (blue line) is shown for mid- and outer-shelf reefs. Blue shading represents 95 per cent credible intervals. Each graph shows trajectories of change over time (based on manta tow surveys). Levels of coral cover are mostly driven by the cumulative impacts of the main disturbances affecting surveyed reefs, including severe cyclones, outbreaks of crown-of-thorns starfish and coral bleaching. Source: Australian Institute of Marine Science, 2023²

The overall condition of seagrass meadows has improved to good (borderline poor), reflecting recovery in northern regions. In contrast to the overall trend, seagrass meadows in the south have continued to decline as a result of flooding impacts in recent years. Little is known about the condition of deep-water seagrass meadows.

Coastal habitats, including mangroves, islands and mainland beaches and coastlines, remain in good condition across the Region. Observed changes in coastlines and coastal habitats have likely been predominantly caused by natural fluctuations in climatic and oceanic processes. Nevertheless, these habitats are expected to be particularly vulnerable to future sea level rise. Other habitats remain in good or very good condition.



Condition of inshore seagrass meadows in each region, 2005–06 to 2022–23

Figure 2.4 in main report: Black line with circles represents the seagrass condition index score. Values are scaled from 0 to 100 (no unit) and colours indicate grade. Dark blue = very good (81–100), light blue = good (61–80), yellow = moderate (41–60), orange = poor (21–40), red = very poor (0–20). The seagrass condition index combines indicators for seagrass abundance (pink line) and resilience (blue line). The condition (and trend in condition) of seagrass meadows varies at a regional scale. Over the past 5 years, condition has stabilised or improved in northern regions, but continued to deteriorate in southern regions. Source: McKenzie et al. (2024)³



Terek sandpipers. © Queensland Government 2023, photographer: Andrew McDougall

Populations of species and groups of species

within the Region also remain in poor condition overall — more than half of the assessed component species and species groups are graded as being in poor or very poor condition. Species assessments reflect both the long-lasting effects of significant historical declines (for example, from commercial harvesting) and the impact of deterioration of the habitats that species depend on.

Considered from a populations perspective, corals improved overall but remain in poor condition.

The 2019 to 2023 window of reduced major disturbances has enabled recovery in cover of

fast-growing coral species in many areas. However, it is likely that alterations to habitat and species diversity remain in a number of areas. This is the context in which the additional effects of the summer 2023–24 mass coral bleaching event will unfold. The condition of seagrasses has improved from poor to good since 2019, reflecting the recovery of seagrasses in northern regions, while seagrasses in the south remain in poor condition.

Marine turtles are in poor condition, and population declines are reported in most species other than southern green turtles and eastern Queensland flatbacks. Dugongs also remain in poor condition, with no consistent trend at a Reef-wide scale. Northern dugong populations are considered stable, but there is a high probability that southern populations have deteriorated. Overall, sharks and rays, sea snakes, seabirds, shorebirds and other (non-coral) invertebrates also remain in poor condition, based on variable and often inferred or limited available data.

Other species components are assessed as being in good or very good condition. Benthic algae, bony fishes and whales have remained in good condition. The overall condition of whales partially reflects the strong recovery of the east coast humpback whale population; the conditions of other whale species are largely inferred. Notably, the condition estuarine crocodiles is considered to have improved and remains in good condition.

Key knowledge gaps remain for many species and habitats that are not comprehensively monitored. The lack of information on many groups of species means that declines may not be evident until critical thresholds are exceeded. For some of the deeper and less accessible habitats, such as Halimeda bioherms and meadows, the continental slope and lagoon floor, knowledge of these habitats have improved since 2019 but remains limited and the condition is still inferred.

The Region's biodiversity has undergone relatively few intense, acute disturbances, such as temperature extremes or cyclones since 2019, although impacts from high temperatures and successive cyclones in late 2023 and early 2024 are not yet fully understood. The threats posed by climate change have not decreased, and most habitats and a range of species remain extremely vulnerable. Future deterioration in their condition is likely if threats persist and windows for recovery are not adequate.

Summary criteria

Habitats to support species

The condition of habitats is poor on a Region-wide scale, as habitat loss, degradation or alteration in a number of areas continues to have significant effects on populations of some dependent species. There is substantial variation in the assessed condition (and trend in condition) of different habitats, as well as in the amount of data available to inform each assessment. Coral reef condition varies between reefs and regions, and between inshore and offshore reefs. Recovery of key reef-building corals, particularly in the northern region, has contributed to an improved trend since 2019, and coral reefs are now assessed to be in poor (borderline good) condition overall. The overall condition of seagrass meadows has also improved since 2019, reflecting the recovery from past flooding impacts in some areas and is now considered in good (borderline poor) condition. Other habitats remain in good or very good condition. Although fewer intense disturbances (temperature extremes, cyclones) have affected habitats since 2019 up until the 2023–24 summer, the threats posed by climate change have not reduced, and most habitats remain extremely vulnerable.*



Populations of species and groups of species

The condition of species and groups of species remains poor on a Region-wide scale, mainly due to the impacts from ongoing climate change and localised reductions in water quality, and there is potential for compounding pressures. There is significant variation between different species and species groups and, in many cases, data are limited. Most populations of marine turtles and seabirds within the Region have declined, as have dugongs in the southern area of the Region, while humpback whales continue to show strong recovery. Increases in cover of some fast-growing corals have occurred, although species diversity and other aspects of coral condition likely remain affected. The condition of seagrasses has improved across many northern regions, but remains poor in the south.*



(*Minor modification of main report text)



3. Ecosystem health

“Dugong are back, seagrass, fish life, the water quality, the whole reef restoration process. This year, I’ve noticed a brighter pink, and that indicates a stronger spawn. It’s been different, and healthier all round. Our coral were able to become more heat tolerant by adapting to conditions and being resilient.”

— Meaghan Cummins, Woppaburra Traditional Owner

The Traditional Owners of the Keppel Islands (16 out of the island group), lying off the Capricorn Coast in Central Queensland – are the sea-faring Woppaburra people. Coral rehabilitation is just one of many marine and cultural projects that has paved the way for the Woppa (island) ‘burra’ (people belonging to) to re-embrace custodianship of their Country and Sea Country.

Source: Caring for Sea Country — Traditional Owner Stories from the Great Barrier Reef ¹

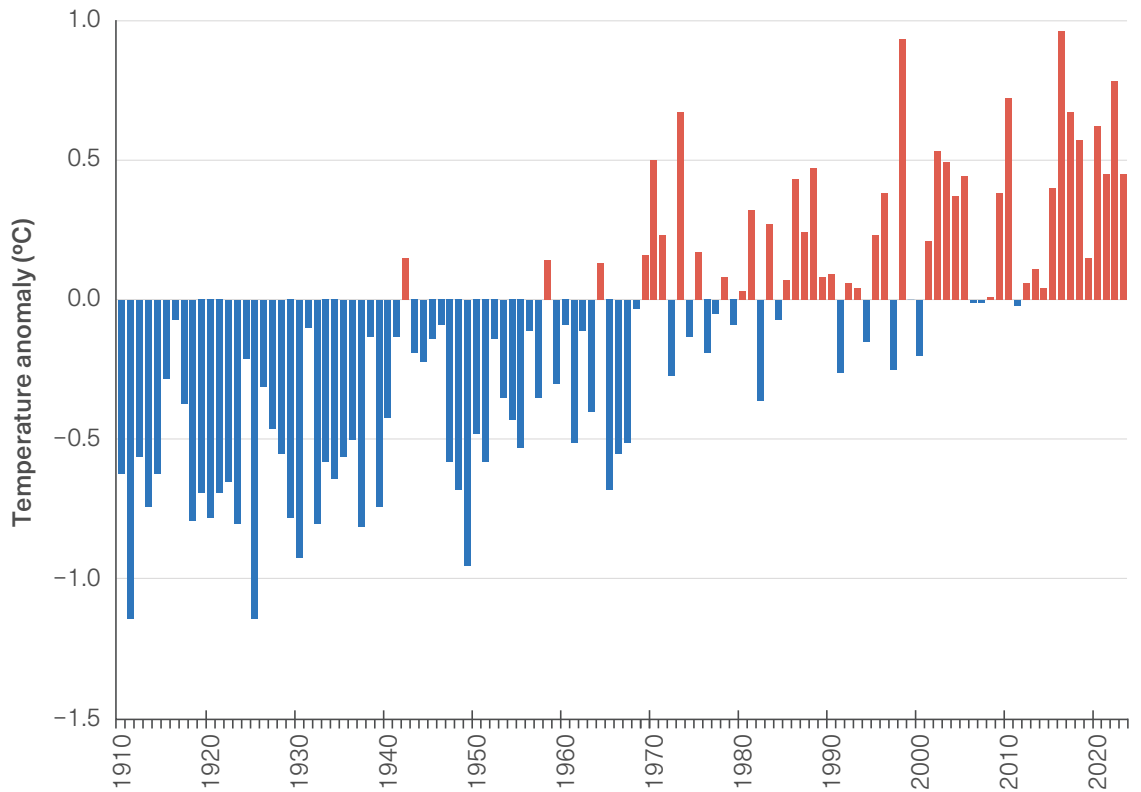
The Region’s ecosystem includes all its species interacting together within the physical and chemical environment. Ecosystem health encompasses these key interactions and processes that operate to keep an ecosystem functioning. For example, without the process of larval dispersal by currents, species and habitats would not replenish after disturbances. Broadscale impacts have more potential than smaller localised impacts to disrupt ecosystem processes.

Change in biodiversity can only be used as an approximate indicator of ecosystem status. An ecosystem is considered healthy if it is able to maintain its structure and function in the face of external pressures. A functioning ecosystem provides a range of services and benefits to humans, including supporting, provisioning, regulating, and cultural services.

In the Outlook Report, the assessment of ecosystem health is based on the condition (and trend in condition) of a range of chemical, physical and ecological processes, the health of connected coastal ecosystems, and impacts of disease and pest outbreaks. Of the 31 components assessed across these areas, about 60 per cent remain in good to very good condition.



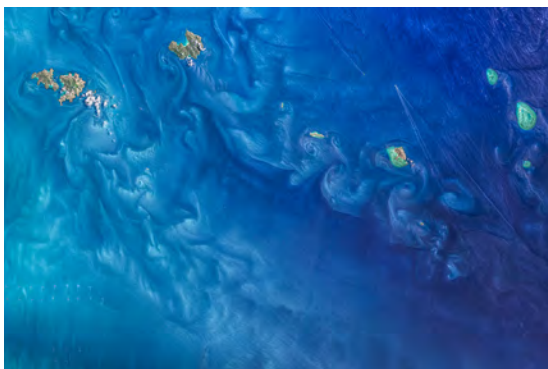
Parrotfish scraping turf algae at Moore Reef. © Commonwealth of Australia (Reef Authority). Photographer: Ryan Ramasamy 2023



Sea surface temperature anomalies for Great Barrier Reef waters, 1910 to 2023

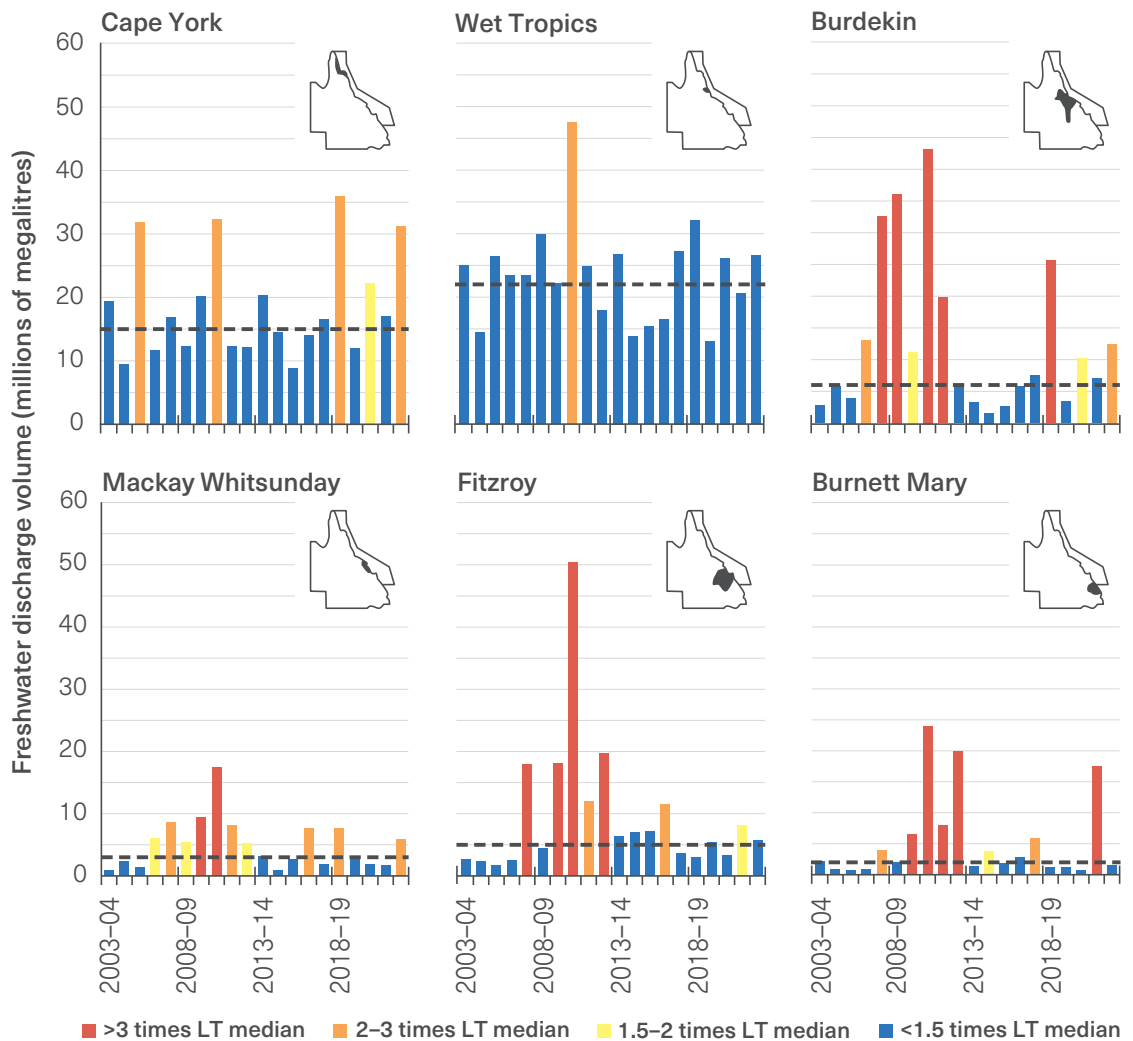
Figure 3.9 in main report: Anomalies are relative to a 30-year climatology (1961 to 1990). Source: Bureau of Meteorology,⁶

Most **physical processes** have remained stable since 2019, but some have continued to deteriorate. Sea temperatures have continued to increase over the past 5 years, and this component remains very poor. Record high sea temperatures were recorded in February 2020, and marine heatwaves triggered mass coral bleaching (although without significant mortality) in both 2020 and 2022. The 2022 event was the first mass bleaching event to occur during a La Niña year. Another mass coral bleaching event unfolded in early 2024, after the end of the 2019 to 2023 assessment period. Sea level is assessed as good but deteriorated. Sea level rise is likely to continue to accelerate and will continue for centuries.



Suspended particles in the water make flow lines from tidal currents and eddies readily visible around islands east of Mackay. © Landsat 8 | NASA Ocean Color Image Gallery 2020

Other physical processes, such as currents, cyclones and wind, sediment exposure, freshwater inflow and light have remained stable since 2019. Currents continue to connect and transport species and nutrients, but changes are starting to occur. Cyclones remain key drivers of ecosystem change. In recent years, freshwater inflow to the Region has been just above the long-term average, but since European settlement has become more variable, with more extremes experienced during wet and dry seasons. Alterations in several other physical processes are expected due to climate change and land-based runoff, and this will have broad implications for the Region.



Annual freshwater discharge from major rivers, by region, 2003-04 to 2022-23

Figure 3.5 in main report: Discharge in millions of megalitres (water monitoring year: 1 October to 30 September) for the 35 main Reef river basins, aggregated into the 6 natural resource management regions. Bar colours: red = >3 times long-term median flow, orange = 2-3 times, yellow = 1.5-2 times, blue = <1.5 times. Dashed grey line indicates long-term median for each natural resource management region. Source: Gruber et al. (2024). ⁷ Data: Department of Regional Development, Manufacturing and Water (2023). ⁸

Chemical processes have remained relatively stable since 2019, except for ocean pH which is good but deteriorated due to increasing atmospheric carbon dioxide concentrations. Ocean salinity is unchanged but may be affected at regional scale by global changes to the water cycle may in the longer term. Nutrient cycling, which continues to be affected by land-based runoff, remains in a poor condition.






Ecological processes have generally remained stable since 2019. However, reef building is assessed to have deteriorated due to likely declines in calcification rates from ocean warming and acidification. The extent to which these have been offset by rapid growth of some corals is not well documented, and improved understanding of the links between coral growth and reef building would help inform future assessments. Trends in other processes, including particle feeding, recruitment and predation, vary between taxa. Declines in recruitment have been reported in some populations of marine turtles and dugongs, for example. The condition (and trend in condition) of some ecological processes, such as microbial processes and competition, remain poorly understood.

Coastal ecosystems that support the Reef remain in poor condition overall, though trends in most components have stabilised. Woodlands and forests is the only coastal ecosystem that has continued to deteriorate, due to ongoing impacts from forest fires and land clearing (although annual clearing rates have reduced in recent years). Continued modification of these ecosystems will reduce carbon sequestration and

storage, increase sediment inflow, reduce connectivity to the Reef, and reduce the capacity of these habitats to support the Region's ecosystems and species.

Outbreaks of disease, introduced species and pest species Outbreaks of crown-of-thorns starfish has improved from very poor to poor. While persistent crown-of-thorns outbreaks at some southern reefs and a new outbreak in the northern region continue to alter ecosystem function on affected reefs, increased efforts in starfish control since the last report have led to both reef- and regional-scale improvements. Outbreaks of disease, which are often linked to environmental stress, and occurrences of introduced species are localised and patchy across the Region and considered stable since 2019. Programs to eradicate introduced pests have been successful on some islands. A long-term increase in *Trichodesmium* abundance has occurred, but data on a Region-wide scale are limited

Summary criteria

<p>Physical processes</p> <p>Most physical processes have remained stable or continued to deteriorate since 2019. Further changes to these processes are expected due to the continued influence of climate change and land-based runoff, which have broad implications for the Region.</p>	 <p>GOOD DETERIORATED</p>
<p>Chemical processes</p> <p>The chemical processes within the Reef are generally in good condition. However nutrient cycling continues to be affected by land-based runoff. Ocean pH has decreased as a result of climate change.</p>	 <p>GOOD STABLE</p>
<p>Ecological processes</p> <p>Since 2019, most ecological processes on the Reef have remained generally stable. Reef building continues to deteriorate due to the impact of ocean acidification on calcification rates. Trends in recruitment are variable, but declines have been observed in some populations, including dugongs, turtles, and some species of coral.</p>	 <p>GOOD STABLE</p>
<p>Coastal ecosystems that support the Great Barrier Reef</p> <p>An understanding of the condition of most coastal ecosystems remains a significant knowledge gap. The extent of each coastal ecosystem has remained generally stable, but woodlands continue to be affected by clearance, albeit at a slower rate than in 2019.</p>	 <p>POOR STABLE</p>
<p>Outbreaks of disease, introduced species and pest species</p> <p>Outbreaks of disease are localised and patchy across the Region, but have generally remained stable since 2019. Increased culling effort has reduced the impact of crown-of-thorns starfish, although the potential for new outbreaks remains. Other outbreaks, such as <i>Trichodesmium</i>, have increased, but data are limited on a broad scale.</p>	 <p>POOR IMPROVED</p>



4. Heritage values

The island of Jiigurru (Lizard Island) is sacred to the Dinggaal Aboriginal people. It is their Country and Sea Country, lying 240 kilometres north of Cairns and 30 kilometres offshore on the northern end of the Great Barrier Reef.

“Within my family, I am teaching them about dance, about songlines, about stories — about how Jiigurru was formed, about thunderstorm and why we can still see clouds hovering over Jiigurru when we look out from the mainland,’ says Gareth.

“Jiigurru is a sacred place where men’s business took place. There are sacred sites everywhere there.”

Gareth Deeral, Jiigurru Traditional Owner

Source: Caring for Sea Country — Traditional Owner Stories from the Great Barrier Reef ¹

The Great Barrier Reef’s heritage values are assessed based on natural (world heritage and national heritage), Indigenous, historic (Commonwealth and other) and other heritage (social, aesthetic and scientific) values.

Natural heritage The Great Barrier Reef remains whole and intact and maintains many of the elements that make up its outstanding universal value, as recognised in its World Heritage listing. Since it was inscribed as a World Heritage Area in 1981, significant components that underpin the four natural world heritage criteria have deteriorated. The size of the World Heritage Area is becoming a less effective buffer against the global impacts of human-induced climate change, which continues to challenge its integrity.

Without additional national and global action to tackle the greatest threats to the Reef through this critical decade and beyond, the protective capacity of size will continue to be eroded by persistent and broadscale impacts on the Region and adjacent areas. The effectiveness of local and regional scale management actions is ultimately impacted by the success of actions to address external influencing factors, for example climate change.



Scientist working with Traditional Owners of Jiigurru (Lizard Island). © Sean Ulm 2022

Indigenous heritage is living heritage which First Nations people continue to practice, providing meaning to everyday life and contributing to the ongoing wellbeing of communities. It includes tangible and intangible heritage and is inseparable from the condition of the Reef’s natural components. Many threats, such as those from climate change, affect Indigenous heritage values through their impact on natural heritage values. These connections between Country, people, and culture are reflected in the Strong Peoples —Strong Country framework.

Loss of Indigenous knowledge, including oral traditions held by Elders, is an ongoing threat; however, the living heritage of First Nations peoples across the Region remains resilient. The COVID-19 pandemic created challenges for intergenerational knowledge transfer.



First Nations peoples are increasingly reasserting their role in Sea Country management and the protection of Indigenous and natural heritage across the Region. Efforts to map sites of cultural importance are advancing in some areas, but recognition and understanding of these in management frameworks remains inadequate. As recognition of the wealth of undocumented Indigenous heritage has increased, it has underlined the limited knowledge in this area. Overall, the Region's Indigenous heritage values are inferred to remain in poor condition.



Strong Peoples — Strong Country

Figure 4.2 in main report: The Strong Peoples — Strong Country Framework 11 identifies six key hubs relevant to Strong Peoples — Strong Country: country health; people's health; heritage and knowledge; culture and community; education; and empowerment and economics. Source: Artwork for Strong Peoples — Strong Country: © Luke Mallie 2018, Mallie Designs. Licensed for use by Reef 2050 Integrated Monitoring and Reporting Program partners.

The **historic heritage** values of the five properties listed on the Commonwealth Heritage List that are in the Region are graded as good, having been identified and included in a relevant inventory. Components of historic heritage encompassing other lightstations, shipwrecks, aircraft wrecks and other places of historical significance remain in poor condition. The condition and trend assessments for most places and artefacts are based on limited published evidence. Positive progress has been made since 2019 towards gathering information on shipwrecks and aircraft wrecks including the possible identification in 2021 of a previously unknown shipwreck as the remains of the Aert van Nes which wrecked on the Great Barrier Reef in 1854.



Commonwealth Heritage listed lighthouse at North Reef Island. © Commonwealth of Australia (Reef Authority).
Photographer: Alicia Moisel 2024

Other heritage values, including social, aesthetic and scientific, are considered in good condition overall. The significance of the World Heritage Area transcends national boundaries and still remains a source of pride for the Australian public. Notable progress has been made since 2019 in understanding the human dimensions of the Reef, particularly around how people value and benefit from the Reef and societal attitudes. People value the Reef and continue to see it as part of their personal and national identity. Perception of the Reef's aesthetic beauty remains high, despite some declines in the condition of habitats and species. People have expressed willingness to undertake actions for Reef health which, in turn, supports human wellbeing. While increased awareness of the threats to the Reef is evident, there is also a general lack of specific knowledge about how to help address and mitigate these threats on a personal level. The Region's scientific heritage value continues to grow. Ongoing efforts are dedicated to preserving the legacy of pioneering science in the Region to ensure its enduring impact on future generations.



The Reef is big, beautiful, diverse, complex and interconnected. © Johnny Gaskell 2022

Summary criteria

Natural heritage values

World heritage value and national heritage value: The Reef's world heritage and national heritage value represents the outstanding universal value of the Region. Outstanding universal value remains; however, the condition of the property has deteriorated to varying extents with respect to specific world heritage criteria (Appendices 3 and 4 in main report). While the property remains whole and intact, ecosystem resilience is deteriorating, and the property's size is becoming less effective as a buffer against persistent and broadscale impacts.*



Indigenous heritage values

First Nations peoples are increasingly reasserting their role in Sea Country management and the protection of Indigenous heritage across the Region. The condition and trend of Indigenous heritage values are tied closely to those of natural heritage values. Knowledge of condition remains limited.



Historic heritage values — Commonwealth heritage values

The condition of the five places in the Region included on the Commonwealth Heritage List is considered good. Published evidence continues to be lacking.



Historic heritage values — other

Gaps in systematic identification and reporting remain for many historic heritage components in the Region. Condition and trend are inferred.



Other heritage values

The Region's scientific heritage value is underpinned by the sharing and creation of knowledge. The Australian people's concern about the declining condition of the Reef remains. Their connection to its environment and natural beauty continues to be strong.



(*Minor modification of main report text)



5. Commercial and non-commercial use

“My passion for the Reef and the marine life it holds will never go away because it is a part of me and makes me who I am. Being a Master Reef Guide and an Indigenous Australian, I can be a role model and show them no matter how hard that it may be, if you carry yourself with pride for your culture and the respect of your family, your buma (people) and your Country, you can be all that you can be.”

Dustin Maloney, Master Reef Guide

Source: Caring for Sea Country — Traditional Owner Stories from the Great Barrier Reef ¹

For tens of thousands of years, the Region has been used by Traditional Owners through their continued connection to their Land and Sea Country and traditional use. Since European settlement, the use of the Region’s ecosystem has increased through a combination of direct and indirect commercial and non-commercial uses.

Commercial and non-commercial uses collectively form an important part of the social and economic fabric that supports the adjacent communities in the Catchment and the broader Australian and international communities. Assessment of the current condition (and trends in condition) of the major uses of the Region is based on the economic and social benefits of use, and the impacts of use on the Region’s values.

The COVID-19 pandemic impacted most direct uses of the Region. Despite this, the economic and social benefits of use are rated as very good. Most direct use of the Region is localised and rated as high impact.



The beauty of the Great Barrier Reef attracts visitors from all over the world © Chris Roelfsema 2021



Within the Region, **commercial marine tourism** is concentrated in about 7 per cent of the area. Tourism visitation was greatly reduced during the COVID-19 pandemic but is recovering. Management of marine tourism in the Region is well established with comprehensive planning, policy and permission systems in place. Increasing visitor and industry participation in the Reef Authority’s site stewardship, Master Reef Guides, and citizen science-focused Eye on the Reef programs benefit Reef management. Marine tourism in the Region contributes significantly to the economy. Local scale impacts include: incompatible uses, where tourism may displace or affect another user group; groundings of vessels; and, in some locations, marine debris and discharge of sewage.



Number of tourism visitor days, 2014 to 2023

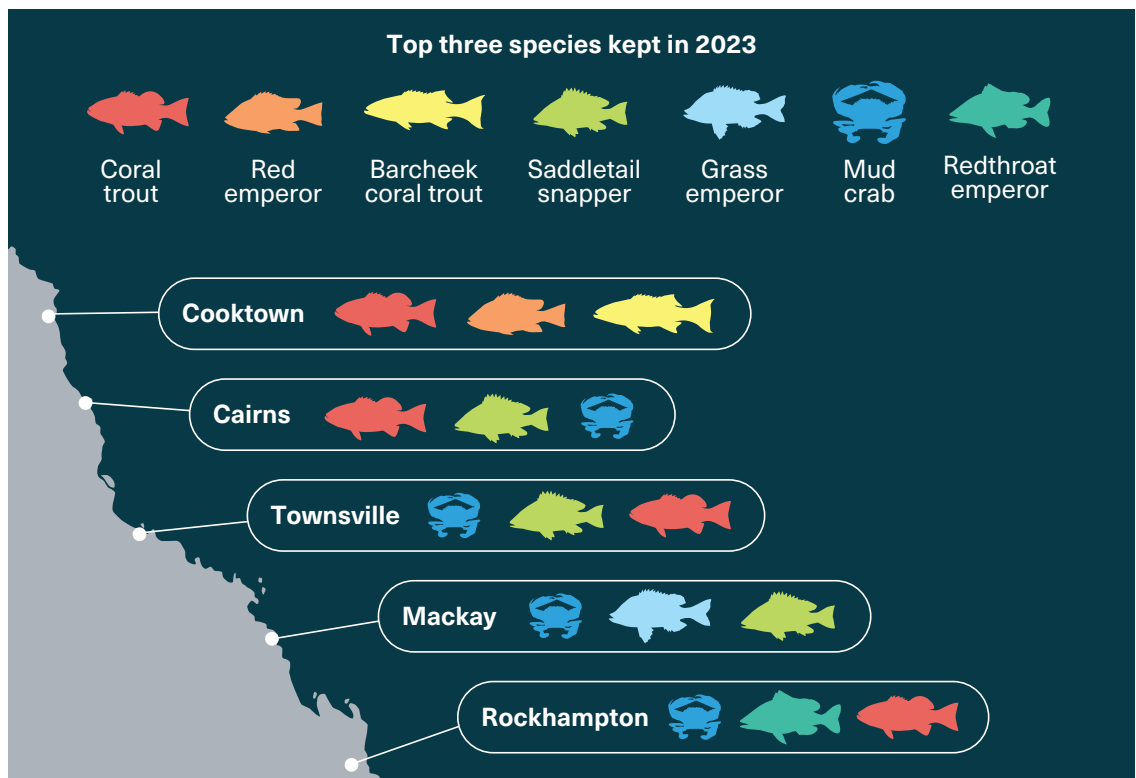
Figure 5.2 in main report (where it has a more detailed caption): A ‘visitor day’ is a visit by one tourist for one day. Tourism visitor day statistics are the total visitation days (including full days, part days and exempt data) and do not include standalone activities (for example, coral viewing, scenic flights or bareboats). During the COVID-19 pandemic, log-books were not mandatory, yet compliance remained at about 99 per cent of tourism operators lodging returns. Source: Great Barrier Reef Marine Park Authority (2024)¹²

Defence activities in the Region contribute to Australia’s national security capability while generating economic benefits. While defence use is localised, expansion of the Shoalwater Bay Training Area will see increased economic benefits and potentially greater impact in the training areas.

Fishing is an important activity in the Region and provides valuable commercial, recreational and cultural benefits for users. It is the largest extractive use of the Region targeting a diversity of species, including fish, sharks, crabs, prawns, rock lobsters, squid, coral and sea cucumbers. During the 2019–20 period, approximately 660,000 Queenslanders participated in 2.8 million days of recreational fishing.

In 2022, the commercial harvest (retained catch) of fisheries product in the Region was about 5000 tonnes, not including marine aquarium fish or coral, and the total charter fishing harvest was about 250 tonnes. Reductions in international trade and exports during the COVID-19 pandemic affected commercial fishing, and border closures also led to a reduction in charter fishing. Fishing is a high impact activity and while there have been improvements through ongoing reforms under the Sustainable Fisheries Strategy, some aspects remain a concern, particularly in relation to depleted stocks and information gaps.

The impacts of **recreation (not including fishing)** are low and generally associated with inshore areas around major coastal communities. Vessel registration has continued to increase with a growing Queensland population. The cumulative impacts of recreational use remain largely unknown.



Top three species caught and kept by recreational fishers during 2023

Figure 5.4 in main report: The ranking is based on number of individuals kept by recreational fishers, using data gathered through recreational fishing surveys at boat ramps. This figure highlights regional variation in the fish species most commonly harvested by recreational fishers. Source: Queensland Department of Agriculture and Fisheries (Qld) 2023.¹³

Research and educational activities provide vital contributions to management of the Reef. A growing research and development program into Reef interventions is driving changes in research activities on the Reef, including novel approaches not yet trialed in the Region. Impacts from research and educational activities are generally considered low. Contemporary information on the contributions of research and educational activities to the Region’s economy is lacking.

Ports form an integral part of the supply chain supporting industries, trade, defence and local communities. Capital dredging occurred as part of three port expansion projects — no material was disposed of in the World Heritage Area. Land reclamation (30 hectares) occurred at Port of Townsville. Maintenance dredging volumes requirements depend on local port characteristics and weather events. Impacts from ports are generally localised These include removal of habitat, increased sedimentation, intermittent noise pollution, spills of cargo and pollutants, and light pollution from port infrastructure. Some impacts associated with port operations have been reduced since 2019, while others persist. Impacts on the Region’s aesthetic values can also result from port operations.

Shipping includes vessels greater than 50 metres in overall length, including large recreational or commercial superyachts and cruise ships, and vessels of any length carrying specialised product, such as chemical or liquified gas carriers and oil tankers. Each year from 2019 to 2022, approximately 3000 ships transited through the Region and approximately 11,000 voyages were made. Vessels that visit ports in the Region provide important services to adjacent communities. Impacts from shipping can arise through ship groundings, operational and accidental discharges of ballast and bilge water, damage to reef structure or seafloor, vessel strikes with marine megafauna and noise pollution. Future shifts to low emissions fuel sources in the industry may reduce impacts.



Ships at anchor in the Region. © Matt Curnock 2022

Traditional use of marine resources are part of first Nations peoples' traditions. Managing agencies continue partnering with Traditional Owners through Traditional Use of Marine Resource Agreements, Indigenous Land Use Agreements and Indigenous Protected Areas to protect Indigenous heritage values, conserve biodiversity and enhance Reef resilience. These programs help Traditional Owners maintain connection with Land and Sea Country. There are 10 Traditional Use of Marine Resource Agreements and 2 Indigenous Land Use Agreements in place which cover more than 46 per cent of the Region's coastline.

Summary criteria

Economic and social benefits of use:

Economic and social benefits to the Region continue to be in very good condition. Despite the COVID-19 pandemic, commercial and non-commercial use contributed significantly to the Region's economy. The Region continues to be critical for the wellbeing of Traditional Owners. Uses such as fishing and recreation contribute to health and wellbeing of people using the Region.



VERY GOOD
STABLE

Impacts of use on the Region's values

The observed impacts from direct use in the Region are predominantly localised but collectively, impacts of use are obvious in many locations. Fishing is a high-impact use occurring throughout the Region. However, reforms are continuing to reduce this impact. COVID-19 saw the reduction of use in many industries but there was an increase in recreational use.



HIGH
STABLE



6. Factors influencing the Region's values

“We have an obligation to preserve and protect Country and Sea Country. If Country is sick, our people are sick. Having people work on Country heals them.”

“The wet season is changing. We need the rains to flush out the creeks and to keep them running. The colour of the water has changed over time. It doesn't run clear anymore, it runs a dirty red, and it's getting worse every year.”

“Our food sources are being affected. Creeks are drying up, as sediment and sand is washing into the creeks and building up along the river and creek banks. Invasive weeds like guinea grass and Singapore daisy, with shallow root systems that don't hold the ground together, are taking over. Elders are noticing a decline in our food sources like bream, mud cod, yabbies, and river mussels, just to name a few.”

“Run off, water quality and physical barriers affects all species that are meant to thrive there, whether they filter the water or use the area for breeding. Aquatic weeds are also choking our waterways in several places.”

“We can restore and heal Country along with our old native species that used to be there, as our seed banks can still be in the ground after all this time.”

Francis Joyce, Mamu Traditional Owner

Mamu Traditional Owner and Senior Ranger, Francis Joyce, leads the first Mamu Healthy Waterways Project for Mamu Aboriginal Corporation Registered Native Title Body Corporate.

Source: Caring for Sea Country — Traditional Owner Stories from the Great Barrier Reef ¹

The primary **factors** influencing the Reef's values are climate change, coastal development, land-based runoff and direct use. These factors are affected by broader drivers of change, including economic growth, population growth, technological development and societal attitudes, that affect how society functions, matures and interacts with the environment. Naturally occurring threats, such as outbreaks of crown-of-thorns starfish or disease, are both influenced by and can contribute to the impact of these influencing factors.

The main **drivers of change** are economic and population growth. Societal attitudes can underpin social values and the way in which people interact with and value the Reef. Understanding changes in these attitudes can help shape management approaches. Drivers of change can also lead to positive changes, for example, commitments to large-scale renewable energy by Australian and Queensland governments are driving infrastructure in the Region and will likely contribute to reducing greenhouse gas emissions. Technological developments are leading to new ways to understand, monitor and manage the Reef's ecosystem.

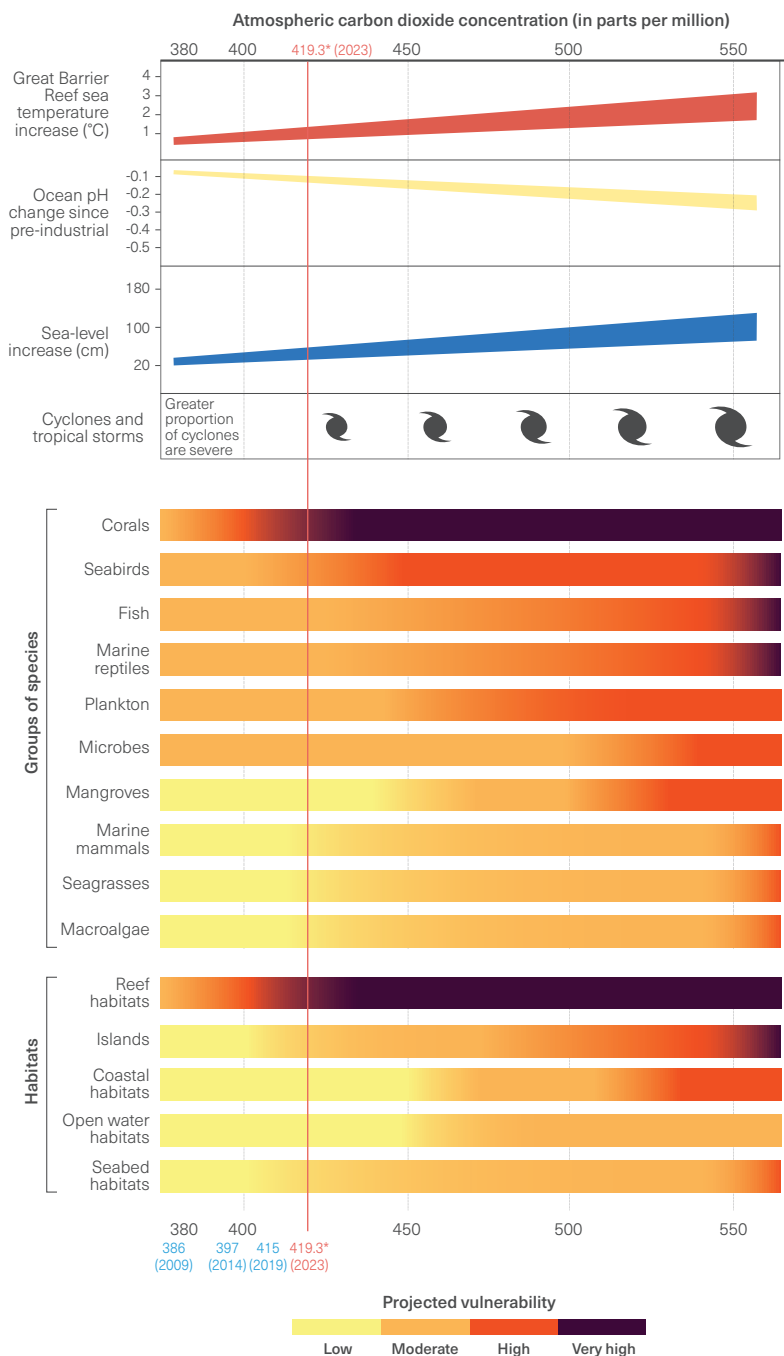


Researchers using a drone at Broadhurst Reef. © Commonwealth of Australia (Reef Authority) 2021



Climate change continues to have the greatest impact on the Region's values, with key indicators like seawater temperatures following trajectories that are directly related to global warming. The impacts of climate change are forecast to become more frequent, severe, and widespread, and climate change will amplify the impacts of other threats. The resultant trend is one of increasing cumulative impacts on the Region's ecological, heritage, economic and social values.

The vulnerability of ecosystems is determined by the level of exposure and sensitivity of species and habitats to disturbances and the ability of ecosystems to tolerate and recover from impacts. The Region's key habitats have a natural resilience against acute physical disturbances, such as cyclones, intense rainfall, freshwater flood plumes and heatwaves. However, climate change is exacerbating acute and chronic disturbances in the Region, shrinking recovery windows and affecting ecological processes that underpin ecosystem resilience.



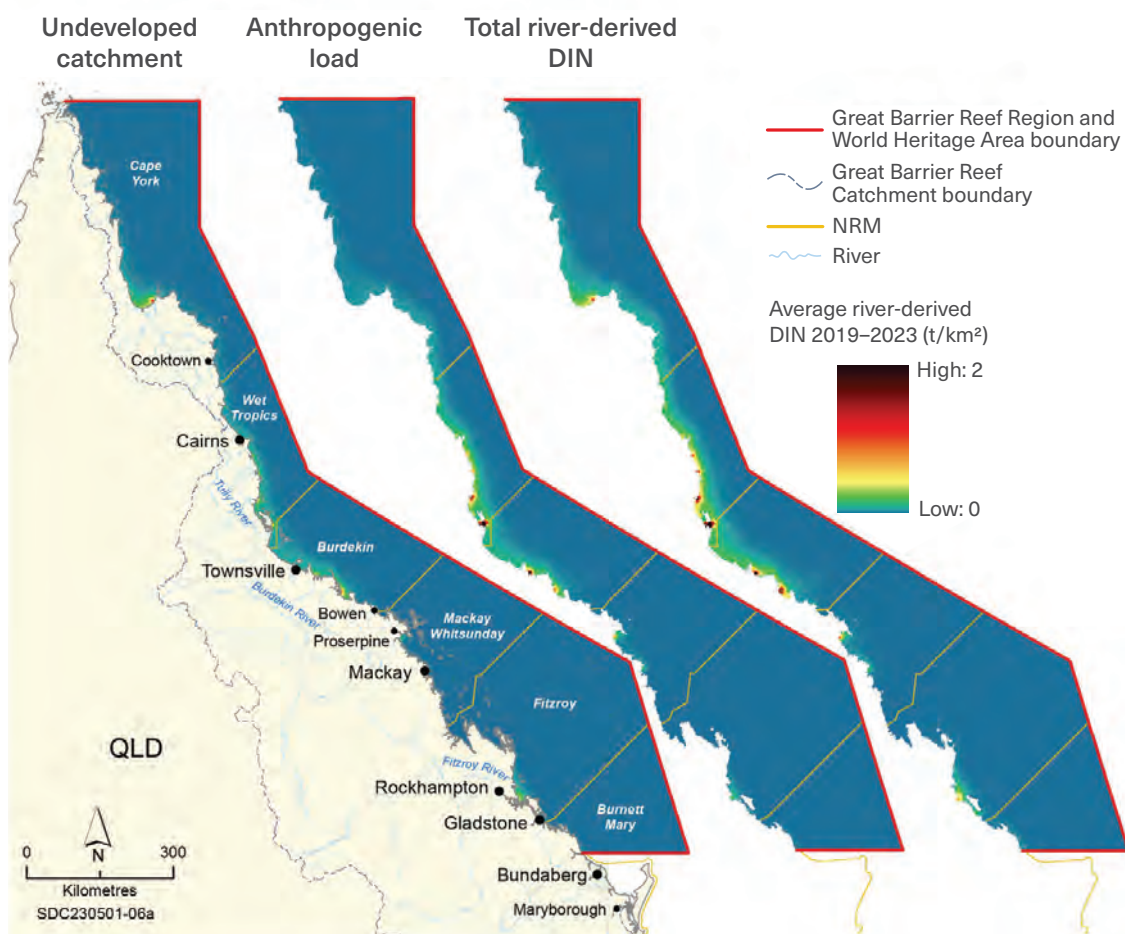
Projected vulnerabilities of components of the Reef ecosystem to climate change

Figure 6.7 in main report: Vulnerability differs for a number of ecosystem components and depends on total atmospheric carbon dioxide concentrations. Changes in sea temperatures, ocean pH and sea level are indicative only, based on latest climate projections.^{21 22} Source: Johnson and Marshall 2007,²³ adapted from values presented in Gattuso et al. 2015²⁴ and Hoegh-Guldberg et al. 2018²⁵ and updated to reflect recent findings from IPCC AR6.²²

*For the first time since human existence, the planet's atmosphere has reached 419.3 ppm

Coastal development has a high impact on ecological and heritage values. Legacy effects of past coastal development, primarily agricultural land uses, barriers to flow, urban development and mining, are still significantly affecting coastal ecosystems adjacent to the Reef. Development is anticipated to increase in line with a growing population, aquaculture is projected to increase within the Catchment and existing and additional modification to coastal ecosystems and barriers to flow will encroach further upon natural and heritage values in the future.

Land-based runoff in the Region continues to affect ecosystems through exposure to pollutants (mainly sediments, nutrients, and pesticides) resulting from unsustainable agricultural land management practices in the Catchment. Recent improvements in water quality across most inshore marine areas of the Reef are encouraging, despite slow progress towards reducing pollutant loads in adjacent catchments. Wind-driven resuspension of sediments will continue to impact water quality in nearshore areas. Despite lag times with catchment improvements, as well as considerable natural variability, the recovery of nearshore ecosystems is closely linked to improved water quality, as evidenced by the improving condition of seagrass meadows. Sustained water quality improvement remains critical for alleviating the compounding effects of climate change.



Average modelled dispersal of river-derived dissolved inorganic nitrogen (DIN) loads for water years 2019 to 2023 (1 October to 30 September)

Figure 6.13 in main report: The maps represent an average from 2019 to 2023 of: (left) DIN loads from a modelled undeveloped catchment; (middle) the anthropogenic component of river-derived DIN; and (right) total river-derived DIN load from the Catchment. Source: Gruber et al., 2024.⁷

Direct use of the Region occurs through a wide range of activities which expose the Reef’s values to a variety of pressures. Recent changes in direct use have been driven by an increasing population, the COVID-19 pandemic, market activity and fisheries reforms. Reductions in use of the Region through the pandemic have mostly reversed, and some impacts from fishing remain.

Vulnerability of heritage values to influencing factors Climate change remains the greatest issue facing the Region's heritage values. The identity of First Nations peoples is embedded in their Sea Country, and pressures exerted on the Region's natural heritage value equally apply pressure on Indigenous heritage value. Climate change effects may also increase impacts to tangible heritage sites through physical weathering, erosion and inundation. Land-based runoff may lead to changes in physical and chemical processes that accelerate the rate of degradation of underwater heritage, while direct use can affect heritage values through inappropriate visitation or behaviour at cultural sites.

The success of Reef-dependent industries, such as commercial fishing and marine tourism, may be affected by the major pressures on the Region. Knowledge gaps remain regarding the specific scale and nature of these effects. Cumulative impacts can also affect people's health, wellbeing, enjoyment, personal connection and appreciation of the Reef.

Summary criteria

Impact on ecological values

Climate change has had a widespread impact on ecological values fundamental to the Region's identity. Repeated mass coral bleaching events in 2020 and 2022 have affected the Reef's ecosystems. Evidence of cascading effects of coral loss on fish and invertebrate abundance and diversity continue to emerge. The strong influence of climate change exacerbates the cumulative pressures of land-based runoff, coastal development and direct use. The ongoing cumulative pressures of these local and global factors are likely to continue to impact the Reef's ecosystems and may limit the potential for ecological recovery.



Impact on heritage values

The Region's natural heritage value is already impacted by climate change, transforming Reef's ecosystems through losses of species and habitats and altered ecological processes. As Indigenous heritage values and Traditional Owners' connection to Sea Country are closely linked to the natural heritage values, these values are under threat due to growing pressure from climate change and local anthropogenic impacts. Projections of intensification of ocean warming and population growth indicate that pressure will continue on the Region's heritage values.



Impact on economic values

The economic value of Reef-dependent uses relies on a healthy Reef ecosystem. For non-Reef-dependent uses, economic value is aligned with market forces and population growth in the Catchment. Effects of ecological declines have become apparent over the past few years. Global and national disruptions due to management of the COVID-19 pandemic led to economic impacts on industries.



Impact on social values

Ecosystem decline as a result of climate change and land-based runoff will affect community health, wellbeing and enjoyment derived from the Region. An increased concern for the Region and its ecosystems has been recorded, particularly for Reef residents who report significant 'Reef Grief'.





7. Existing protection and management

First Nations women are taking a lead role in the management of Reef habitats through programs such as the Sea Women of the Great Barrier Reef program. This is an intensive capacity-building training program delivered on Yunbenun Magnetic Island, bringing together women from North Queensland, Zenadth Kes (Torres Straits Islands) and Papua New Guinea.

“Not many women have had the chance to get out and do this work. It’s been male-dominated, and men have usually got first preference. It’s a big step for women and we now also have a Queensland network of Indigenous female rangers, and it’s growing all the time.”

Olivia Mooka, a Girrungun Traditional Owner and program participant

Source: Caring for Sea Country — Traditional Owner Stories from the Great Barrier Reef ¹

Effective management of the Region depends on partnerships between government, Traditional Owners, industry and community. Protection and management issues are complex, given the wide range of activities that occur in the Region and its Catchment, and the variety of effects these activities can have on the Reef.

For the Outlook Report 2024, an assessment of the effectiveness of existing measures to manage and protect the Region’s ecosystem and heritage values was undertaken by independent assessors.

The independent assessment focused on 6 elements of the management cycle: context, planning, inputs, processes, outputs and outcomes. In doing so it addressed 14 broad management topics and considered the activities of relevant Australian and Queensland government agencies and other contributing partners, undertaken both inside and outside the Region.



Framework for assessing management effectiveness of protected areas

Figure 7.2 in main report: Effective management is a closed loop where issues are considered, plans are made, resources are expanded, processes are followed and products and services are delivered, all leading to outcomes that address the issues¹⁴



The assessment found the Region continues to be well managed overall, with over 80 per cent of elements across the management topics considered effective or mostly effective. Notable management improvements since 2019 include the enhanced funding and planning initiatives through the Reef 2050 Plan and Queensland Sustainable Fisheries Strategy 2017-2027. However, for some aspects of management, declines in effectiveness have occurred since 2019.

Managing direct use Direct use of the Region is generally well-managed, likely due to the lower complexity involved (compared with managing external factors) and the maturity of management systems. Specifically, well-resourced planning and management systems are in place to support sustainable commercial marine tourism activities, while defence activities and shipping are both considered well-regulated and effectively managed. Port authorities are typically well resourced and provide a high degree of environmental management in relation to port activities which carry with them a range of risks. Fishing management outcomes remain only partially effective in 2024, however significant reform is being implemented through the Queensland Sustainable Fisheries Strategy. Traditional use of marine resources and management of Sea Country have been assisted by Traditional Use of Marine Resources Agreements. 'Agreement to Partner' is a key step in progressing Traditional Owner aspirations for the Reef. Research activities and recreational use are generally considered well managed and low risk, but knowledge gaps remain regarding both the cumulative impacts of research activities and in the changing nature and scale of recreational use in the Region.



Ship being towed into port. © Commonwealth of Australia (Reef Authority)



Partnerships with Traditional Owners are key to protecting and managing Country. © Queensland Government 2022

Managing external factors External factors influencing the Region include climate change, coastal development and land-based runoff. Management is considered weakest for climate change and coastal development. Nevertheless, climate change has seen the most improvement in management effectiveness since 2019, including enhanced management of climate change risks and advances in climate change policy at national, state and local levels. Notable policy advances include the introduction of the Climate Change Act 2022 (Cth) and the inclusion of a specific work area under the Reef 2050 Plan that articulates

clear goals and strategic actions towards achieving emission reduction targets. Despite this progress in policy, the management of the Reef regarding climate change remains subject to significant challenges. Coastal development activities are managed within a multi-level governance system. Planning systems are well developed, but integration and coordination between land- and marine-based planning is a significant challenge. While improvements have occurred in the management of land-based runoff along with a general reduction in pollutant loads since 2019, it is not expected that the 2025 water quality targets will be met.

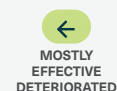
Managing to protect the Region's values Management to protect the Region's biodiversity, heritage and community benefit values is mostly effective. However, inputs to management of heritage and community benefits have not improved from partially effective, and achievement of heritage and biodiversity outcomes has been trending downward since 2019.

While the challenges involved in managing a large and diverse system are significant, many threats to the Reef are being addressed in meaningful and positive ways. For instance, managers are using research to inform planning and management, extensive on-ground work has been undertaken since 2019, and partnerships have increased in number and diversity and are underpinned by increasingly complex arrangements. Opportunities to improve resourcing of effective engagement and partnering with Traditional Owners, and development of greater cross-sectoral and cross-scale data management, coordination and collaboration will be important in the near future.

Summary criteria

Understanding of context

Context was the strongest element in the management effectiveness framework. Managers generally had a good and improving understanding of the values relevant to each management topic (although this was weakest for heritage and coastal development), national and international influences, and key stakeholders. While condition and trends for each topic were generally known, threats and their impacts were less well known. Specifically, the cumulative and consequential impacts of threats were generally poorly understood across most management topics.



Planning

Planning performed well in relation to overall management effectiveness with no topics being graded as ineffective or partly effective. Reef planning is spatially complex, spanning marine and terrestrial environments and requires effective coordination of actors and systems. Management topic-specific legislation, plans and policies apply across multiple spatial scales (international to local) and sectors. The Reef 2050 Plan is the overarching plan addressing most of the key elements required for effective Reef management and the Intergovernmental Agreement sets the framework for joint coordination of planning and management. Strengths of planning include certainty around where activity can occur (Zoning Plan), setting clear actions and planning consistency across jurisdictions (Reef 2050 Plan).



Financial, staffing and information inputs

Inputs for most topics were graded as mostly effective, with four topics rated as partially effective (climate change, coastal development, heritage and community benefits). Funding in general, has increased across most topics with improvements in the funding for water quality improvement, Reef management and conservation, Reef restoration and adaptation, and strengthening partnerships and stewardship. Innovative funding strategies are being developed (for example the Reef Recovery 2030 fundraising campaign by the Reef Trust Partnership). The adequacy of human resourcing within all managing organisations was the weakest of all topics and was partly impacted by COVID-19. Data inputs overall are effective, although there are gaps in Indigenous heritage and historic heritage information. Provisioning of adequate data sharing platforms was also identified as a key deficit particularly for research efforts. Non-government involvement was also mostly effective reflecting the strong level of community engagement and interest in the Reef.



Financial, staffing and information inputs

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Delivery of outputs

Outputs remained stable for the majority of topics. Upward grade changes, such as that for climate change, reflect the improvement in the planning system. Declines across research, traditional use of marine resources and land-based runoff are a result of resourcing issues during the period of COVID-19 restrictions, which impacted the outputs that could be delivered. While the delivery of outputs was generally strong, especially in terms of delivering products and related actions, there were weaknesses in achievement of results against objectives. This in part reflects the absence of clear objectives for some management topics or misalignment of outputs with expected objectives.



Achievement of outcomes

The achievement of outcomes was the weakest of all elements of the management effectiveness framework. However, results were highly variable across the management topics with most direct use areas performing well but external factors and overall values performing poorly. The outcomes for five topics were graded as partially effective for biodiversity, coastal development, fishing, heritage and land-based runoff. The management outcomes for climate change was graded as ineffective. The relatively poor achievement of outcomes partly reflects a range of external influences on the Reef (such as bleaching events and climate change stressors) but also reflects an increasing understanding of the extent of existing impacts. Outcomes for climate change and biodiversity were poor across a number of indicators, including the protection of values, reduction of threats, and environmental, economic and social sustainability. Poor outcomes for heritage reflect the poor and deteriorating condition of many Indigenous heritage values and many historic heritage sites, especially underwater cultural heritage. However, there was evidence of effective partnerships across most of the management topics.

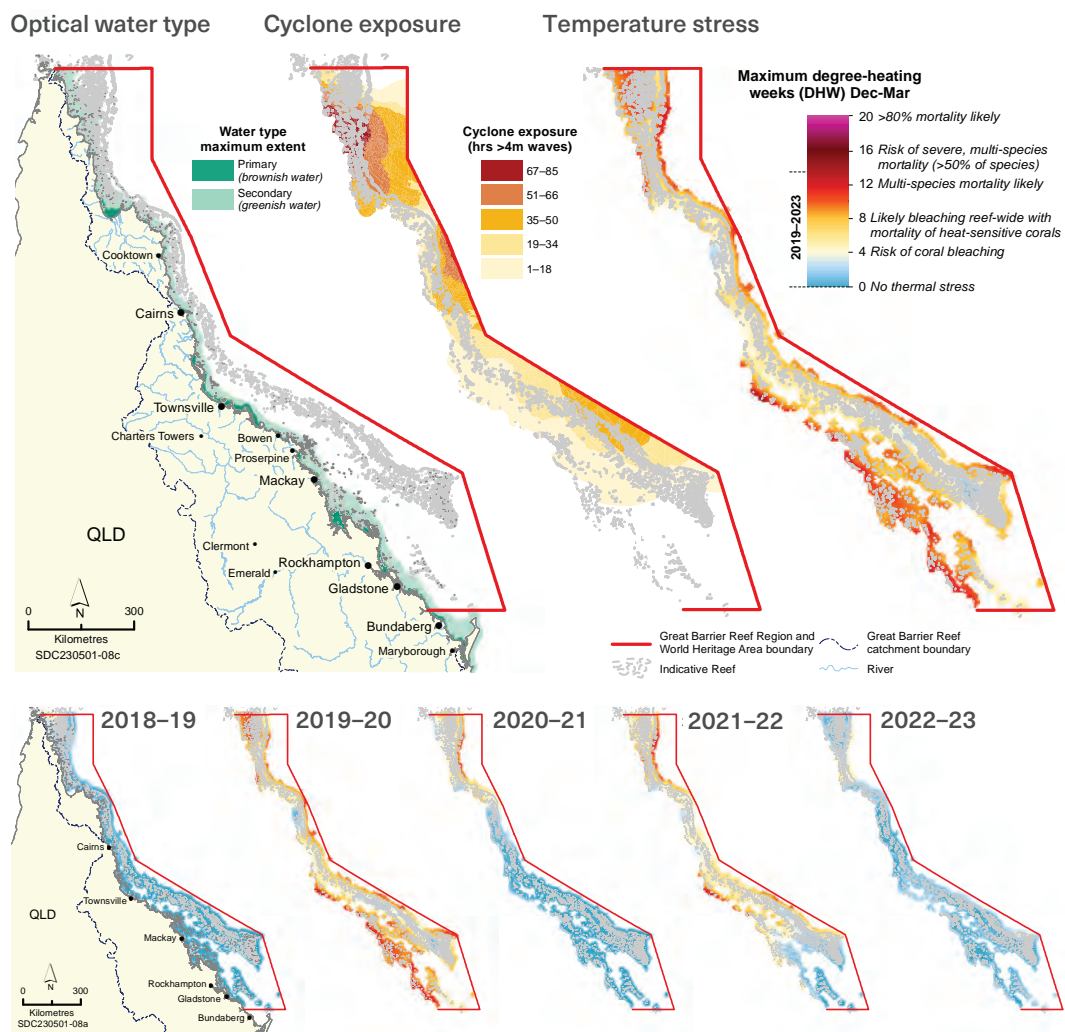




8. Resilience

A resilient system is one that is ever-changing and can resist and/or recover from abrupt changes or adapt to gradual ones, while maintaining its key components. These are its identity (including values and integrity), its structure (including communities and biodiversity) and its function (including social and ecological processes). Effective management can strengthen a social-ecological system's resilience.

The Region is home to the world's largest coral reef ecosystem with enduring natural, social and heritage values. Widespread disturbances, such as repeated mass bleaching events, cyclones, reduced water quality, and outbreaks of crown-of-thorn starfish can have negative impacts on the overall resilience of the Reef. Yet, impacts on the Reef have been highly variable, and some ecosystems have demonstrated capacity to recover. The natural resilience of the Region's values is being undermined by increases in the severity and frequency of disturbances.



Multiple disturbances affecting the Great Barrier Reef, 2018-19 to 2022-23, December to March

Figure 8.3 (part) in main report: Exposure for three important stressors across the entire period: left, maximum extent of primary and secondary water types; middle, total accumulated exposure to cyclone-generated waves exceeding 4 metres; and right, thermal stress as maximum degree heating weeks reached between 01 December to 31 March for the 2018-19 to 2022-23 summers. Please refer to main report for further detail. Source: Water type data from TropWater at James Cook University 15 and 4 metre wave modelling data from the Australian Institute of Marine Science. 16 Degree heating weeks (DHW) data from the US National Oceanic and Atmospheric Administration (NOAA) is a Coral Reef Watch analysis of maximum accumulated thermal stress (DHW) for the bleaching season, December-March.¹⁷



“I feel like us being able to work on Country and to be based on Country, it’s important for value sharing into our community, we have respect for what we hold culturally, and the more people know about what is happening on Country, the healthier country is, the healthier people are, and the more they want to care for Country.”

— Rohann Sultan, Mandubarra Traditional Owner.

Source: Caring for Sea Country — Traditional Owner Stories from the Great Barrier Reef ¹

The Region’s resilience is assessed through nine case studies (seven ecosystem case studies and two heritage case studies).

The responses of **coral reef habitats** to global and local stressors have been highly variable. Coral reef habitats have demonstrated some natural resilience through the ability to start recovery. Offshore reefs have shown signs of recovery in coral reef condition following repeated mass bleaching events, primarily associated with increases in coral cover of fast-growing *Acropora*. These corals are extremely sensitive to future acute disturbances. Coral cover does not reveal information such as diversity, coral reef community composition, or demography and recruitment of key reef species. These elements are vital for ecosystem resilience. Therefore, coral reef habitats remain vulnerable to further disturbances as changes to *Acropora*-dominated communities may result in the erosion of the resilience. As recovery windows diminish so does the capacity to bounce back from disturbances each time.



Monitoring seagrass flowers informs resilience measures.
© Kor-jent van Dijk 2009

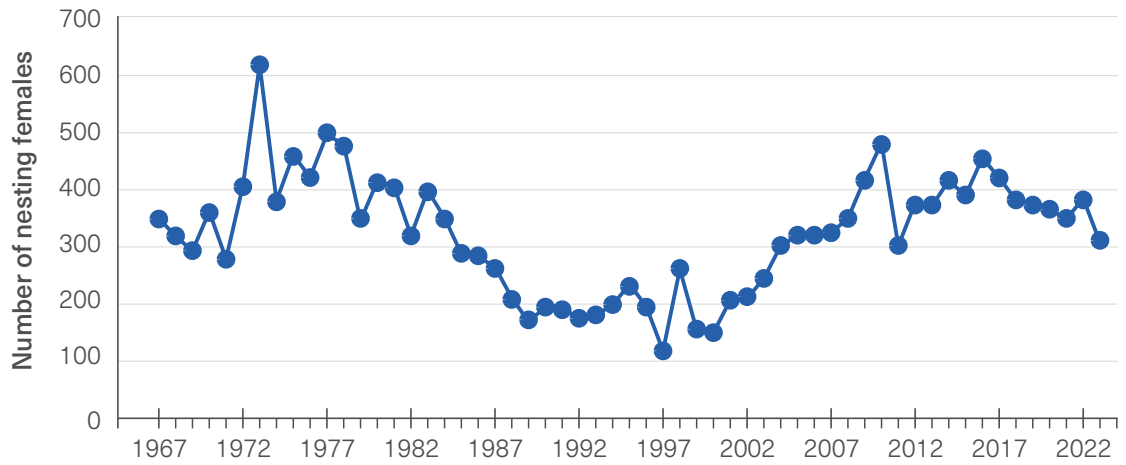
dugongs have been showing declines in population and recruitment and continue to be affected by global and local disturbances. Loss of seagrass habitat remains one of the main causes of dugong mortality, particularly in the southern Region.

While loggerhead turtle populations recovered to a certain degree over past decades due to local interventions, numbers of nesting females have been declining more recently. Impacts, such as fishing bycatch, marine debris, and temperature increases continue to threaten the resilience of turtle populations.

Seagrass meadows in the northern Region have been recovering from recent cumulative disturbances, while the southern meadows remain vulnerable especially after the 2020 floods in Mary Burnett catchments.

Humpback whales are the only component described in the case studies that has made a strong recovery following historic declines. Their recovery is due to international legislation put in place several decades ago to protect these species from hunting in the Southern Ocean.

Black teatfish populations have recovered from their lowest point in the 1920s and the fishery re-opened in 2019, but the degree of improvement over the past 2 decades is less certain. The latest coral trout assessment indicates that stocks are recovering, however, they remain sensitive to coral habitat loss, and risk of overfishing. In contrast, urban coast



Number of tagged loggerhead turtles nesting, Woongarra coast, 1967 to 2023

Figure 8.7 in main report: Data for the 1967 and 1968 nesting seasons are population estimates. Data for nesting seasons from 1969 to 2023 are derived from population censuses. Nesting seasons occur over summer and are referred to by the year in which they start. Source: Queensland Department of Environment and Science 2023¹⁸ and Limpus 2008.¹⁹

Social heritage values are being maintained, as demonstrated by strong evidence from the Reef’s tourism industry. The tourism industry was significantly affected by repeated mass coral bleaching events and more recently the COVID-19 pandemic. The industry has shown great resilience to adapt to changes and enhanced stewardship of the Reef through new partnerships. However, the resilience of social values is only as strong as the resilience of the ecosystems that underpin it. In this complex social–ecological Reef system, a resilience-based management approach will continue to be vital for the maintenance of the outstanding universal value of the Region.

The practice of cultural lore, one of many mapped Mandubarra cultural values, is a central tenet of the protection of threatened species for Mandubarra traditional Custodians.

“Turtles are our totem, but it also comes back to turtle rehabilitation. The last few years there hasn’t been any hatchling or nesting so Uncle James has used turtles’ totemic value to be a way of offering protection for them.”

— Mel Ball, Mandubarra Traditional Owner

Source: Caring for Sea Country — Traditional Owner Stories from the Great Barrier Reef ¹

The Reef’s Traditional Owners are the custodians of Indigenous heritage values, and resilience of these values depends on continuing connection to culture and Sea Country. The protection of culturally important sites is built on strong traditions of intergenerational knowledge sharing within and between communities, according to traditional Lore, customs, and cultural authority governance systems. Indigenous knowledge of Country and management practices provide a valuable approach for caring for the environment for all Australians. Strong governance and co-management principles, that connect Traditional Owners and custodians to their Country, and supports the agency of First Nations peoples’ agency in land and sea country management will benefit the resilience of ecosystem and heritage values of the Reef.



Participants at the Mandubarra Cultural Values Launch. © Commonwealth of Australia (Reef Authority) 2021

Summary criteria

Ecosystem resilience

Elements of the natural ecosystem have been severely affected by repeated mass bleaching events, heavy floods and marine pollution. These elements include coral reef habitats, dugong populations, and loggerhead turtles. The resilience of these species and communities is likely to be compromised. Recovery has been observed in seagrass meadows in the northern Region although the southern meadows are likely to be less resilient to future disturbances. Coral trout and black teatfish populations have also shown signs of recovery. It is projected that humpback whales will reach carrying capacity before 2026, showing how management actions can support recovery of natural populations.



Heritage resilience

The resilience of Indigenous heritage values continues to depend on the active involvement of First Nations peoples in management and their connection and access to Land and Sea Country. The resilience of social heritage values similarly depends on the strength of human relationships combined with the health of the Reef. Resilience of historic heritage values has not been widely analysed by managers. Based on available evidence, the resilience of the Region's heritage values is assessed as good.





9. Risks to the Region's values

“As Traditional Owners we have been on Country and Sea Country for a very long time. Through our ancestors, we are the first traditional Custodians, it’s where we learnt biodiversity. We were the land managers for millennia. We’ve got the knowledge on how to read country, manage country and we want to work together and come up with a plan to co-manage country.”

Brendan Fletcher, Traditional Owner, Gurang People

Source: Caring for Sea Country — Traditional Owner Stories from the Great Barrier Reef ¹

Management of the Region must consider the full range of threats to the Region’s ecosystem and heritage values (natural, Indigenous, historic and other heritage values).

The risk assessment is based on the information presented in chapters 2 to 8. The assessment systematically reviews the current and future risks presented by known threats and summarises the residual risk to the Reef after consideration of existing protection and management measures. Input from Reef scientists, managers, Traditional Owners and heritage experts was considered through a series of elicitation workshops.



A lemon damselfish sheltering in bleached coral. © Johnny Gaskell 2020

In total 45 identified threats were assessed. Of these, 8 were identified as presenting a very high risk to the Region’s ecosystem and heritage values. Another 13 and 18 are rated as high risk to the Region’s ecosystem and heritage values, respectively.

The identified threats to the Region’s values are highly variable in space and time and arise from a range of sources (such as climate change, coastal development, land-based run-off and direct use). As ecosystem components and heritage values are closely connected, the projected risk for many threats is similar for both values.

The overall risk to both ecosystem and heritage values remains very high. The most serious threats are associated with climate change, coastal development, land-based run-off and some aspects of direct.

Climate change Threats such as sea temperature, ocean acidification, altered weather patterns and rising sea level have the highest negative impacts on the Region and risk levels are expected to continue increasing into the future.

Land-based runoff Threats such as nutrient and sediment runoff are currently assessed as very high risk. However implementation of programs and practices to reduce impacts should see these risks decrease in the future, albeit with a lag time on realisation of the outcomes from work already completed or to come.

Coastal development Associated threats remain a high risk to ecosystem and heritage values under current management, which is generally considered partially effective.

Direct use Management plans, policies and activities are keeping many risk levels stable. For example, strong management of commercial marine tourism and defence activities contribute to an overall assessment of low risk for these direct uses. However, some threats associated with direct use, such as illegal fishing and extraction, pose a serious risk to the Region’s values.



Threats	Risk		Timing	Influencing factor			
	Ecosystem	Heritage values		Climate change	Coastal development	Land-based runoff	Direct use
Altered weather patterns	Very high risk	Very high risk	Now	●			
Ocean acidification	Very high risk	Very high risk	Now	●			
Sea-temperature increase	Very high risk	Very high risk	Now	●			
Sea-level rise	Very high risk	Very high risk	10+	●			
Modifying coastal habitats	Very high risk	Very high risk	Now		●		
Nutrient runoff	Very high risk	Very high risk	Now		●	●	
Sediment runoff	Very high risk	Very high risk	Now		●	●	
Illegal fishing and extraction	Very high risk	Very high risk	Now				●
Altered ocean currents	High risk	High risk	Now	●			
Barriers to flow	High risk	High risk	Now		●		
Discarded catch	High risk	High risk	Now				●
Extraction of particle feeders	High risk	High risk	Now				●
Extraction of predators	High risk	High risk	Now				●
Foundational capacity gaps		High risk	Now				●
Fragmentation of cultural knowledge		High risk	Now				●
Incidental catch of species of conservation concern	High risk	High risk	Now				●
Incompatible uses		High risk	Now				●
Marine debris	High risk	High risk	Now		●	●	●
Outbreak of crown-of-thorns starfish	High risk	High risk	Now			●	●
Artificial light	High risk	High risk	Now		●		●
Behaviour impacting heritage values		High risk	Now				●
Damage to reef structure	High risk	High risk	Now				●
Extraction from spawning aggregations	High risk	High risk	Now				●
Outbreaks of disease	High risk	High risk	Now	Cumulative effect of many factors			
Pesticide runoff	High risk	High risk	Now			●	
Illegal activities — other	High risk	High risk	Now				●
Acid sulfate soils	Medium risk	Medium risk	Now		●	●	
Damage to seafloor	Medium risk	Medium risk	Now				●
Disposal of dredge material	Medium risk	Medium risk	Now		●		●
Dredging	Medium risk	Medium risk	Now		●		●
Exotic species	Medium risk	Medium risk	Now		●	●	●
Genetic modification	Medium risk	Medium risk	Now				●
Grounding — large vessel	Medium risk	Medium risk	Now				●
Grounding — small vessel	Medium risk	Medium risk	Now				●
Noise pollution	Medium risk	Medium risk	Now		●		●
Outbreak of other species	Medium risk	Medium risk	Now	Cumulative effect of many factors			
Spill — large chemical	Medium risk	Medium risk	Now		●		●
Spill — large oil	Medium risk	Medium risk	Now		●		●
Terrestrial discharge	Medium risk	Medium risk	Now			●	
Vessel strike	Medium risk	Medium risk	Now				●
Vessel waste discharge	Medium risk	Medium risk	Now				●
Wildlife disturbance	Medium risk	Medium risk	Now				●
Extraction of herbivores	Medium risk	Low risk	Now				●
Atmospheric pollution	Low risk	Low risk	Now		●		●
Spill — small	Low risk	Low risk	Now				●

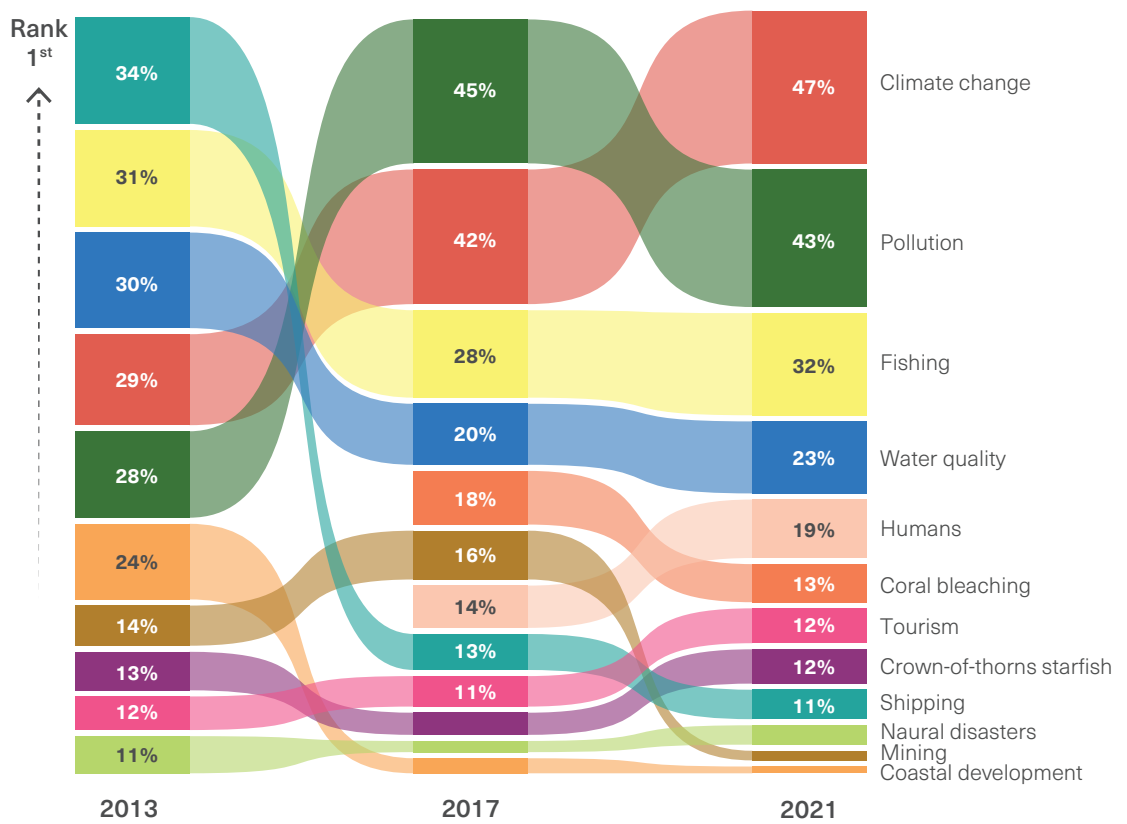
Threat	Risk	Timing
Region-wide	Low risk	Now
Local or regional	Medium risk	10+ More than 10 years
	High risk	
	Very high risk	

Summary of threats arising from factors influencing the Region's values, and associated scale, timing and risk level
 Figure 9.3 in main report: This figure links identified threats with the key factors (Chapter 6) that have most influence on them, either directly or indirectly, indicated by a black dot. Instances where a factor is likely to only have an insignificant influence on a threat are not displayed (no dot shown). The risk level for each threat is shown, along with the scale of the risk and expected timing of the effects of the threat.

Community views on the major threats to the Reef are generally aligned with those identified through the risk assessments in this chapter. While climate change is perceived as the greatest threat to the Reef, Catchment residents viewed illegal fishing and land-based run-off as among other serious threats to the Reef and catchment waterways.

Since 2019, the assessed risk level has decreased for 2 threats, as a direct result of management actions: incidental catch of species of conservation concern and outbreaks of crown-of-thorns starfish. Three risks are assessed to have increased since 2019: genetic modification, behaviour impacting heritage values, and foundational capacity gaps. The increased risk level of foundational capacity gaps is underpinned by a deeper understanding of the impacts of a lack of agency of First Nations peoples in management of, and differences in access to, Sea Country. Co-management principles and integration of Traditional Knowledge into decision making will be key to reducing risk levels.

Climate change challenges the natural resilience of the Region’s key habitats through exacerbating both acute and chronic disturbances, shrinking recovery windows and affecting ecological processes that underpin ecosystem resilience. It is vital to continue to understand and respond to cumulative impacts.



Reef residents' perception of threats to the Great Barrier Reef

Figure 9.1 in main report: These results, from the Social and Economic Long-Term Monitoring Program survey 2021, are in response to the open-ended question: 'What do you think are the three most serious threats to the Great Barrier Reef?' Source: Hobman et al. 2022²⁰

When *Shen Neng 1* ran aground in April 2010, it caused extensive damage to Douglas Shoal on the Sea Country of the Gooreng Gooreng, Gurang, Byellee and Tarebilang Bunda people. In 2023, following extensive remediation to the site, and with long-term involvement from Gidarjil Development Corporation, Sea Country is being restored.

“Mob’s role has been key. Young Indigenous rangers and Elders have all been involved with the remedial project. We initially sent out three rangers and went out and did surveys and that was using scuba divers to survey the damage done. All the rangers are Traditional Owners, and it was a large achievement for them to be involved in such a large project.”

“Through these partnerships with the Reef Authority and Boskalis and our ability to use technology, it’s become a great tool for us to teach young Indigenous people the technology.”

Brendan Fletcher, Traditional Owner, Gurang People

Source: Caring for Sea Country — Traditional Owner Stories from the Great Barrier Reef ¹

Summary criteria

Overall risk to the ecosystem (natural heritage values)

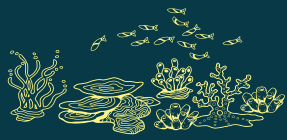
Threats to the Region’s ecosystem are multiple, compounded and expected to pose increasing risk, putting the ecosystem at very high risk. The most serious risks are from threats associated with climate change, coastal development, land-based runoff and some aspects of direct use (such as illegal fishing and extraction).



Overall risk to heritage values (Indigenous, historic and other heritage values)

Heritage values are at very high and increasing risk. The close connection between many heritage and ecosystem values means the risk from most threats is the same for heritage values as for the ecosystem. Additional high risk threats, particularly for Indigenous values, are fragmentation of cultural knowledge, foundational capacity gaps and behaviours affecting heritage values.





10. Long-term outlook

“Our outlook has always been one of nurture — our health, our story and our spirit are tied to the spirit and health of Country — when she is well, we are well.”

Mel Ball, Mandubarra Traditional Owner

Source: Caring for Sea Country — Traditional Owner Stories from the Great Barrier Reef ¹

The Great Barrier Reef remains a wonder of the natural world, but it faces an uncertain future. Rising global temperatures are driving unprecedented changes to key habitats, species, and ecosystem processes. These changes will inevitably affect Reef-dependent human communities as well. Actions taken now, if implemented effectively, could reduce these impacts.

The Region’s current outlook remains one of continued deterioration. Warming already locked into the global climate system will have profound effects on the Region’s ecosystems over the next decade and beyond, and unchecked warming would be devastating for the Reef. The window of opportunity for changing direction is closing rapidly. Only the strongest and fastest possible actions to decrease global greenhouse gas emissions will reduce the risks and limit the impacts of climate change on the Reef. Timely and effective management actions taken now can dramatically alter potential futures.

Although some changes are occurring gradually, most of the outcomes of steadily rising greenhouse gas concentrations are experienced as extreme events. Among the most pressing and inevitable of these are widespread marine heatwaves that can cause mass bleaching and death of corals — and affect a range of other species and habitats — on a Region-wide scale. Historically such events have been rare, but the chances of them occurring increase with every increment of global warming.



Snorkeller taking photos of a reef © Johnny Gaskell 2021



Beach on Konomie (formerly known as North Keppel Island). © Reef Authority. Photographer Ryan Ramasamy 2023

“One of my main purposes is working on Country and I feel proud. Hopefully the bloodline can keep working on Country.”

— Frederick Lefoe, Gunggandji-Mandingalbay Yidinji Traditional Owner and former Indigenous Ranger
Source: Caring for Sea Country — Traditional Owner Stories from the Great Barrier Reef ¹

Periods with relatively few acute disturbances, such as the past 5 years, provide vital recovery windows, but these temporary reprieves will become fewer and shorter for as long as greenhouse gas concentrations continue to rise.

Efforts to enhance the resilience of Reef ecosystems' resilience are vital, as they enable better resistance and recovery from disturbances. The identification and protection of places (including climate refugia), habitats, species and ecosystem processes critical for resilience is urgent.

The Region was at a crossroads in 2009, with an opportunity for the right decisions to protect the Reef into the future. Since then, the global community has made uneven progress towards the decarbonisation objectives articulated in the Paris Agreement of 2015. The Reef is a global icon at imminent threat if climate objectives are not met, and even if they are, every increment of additional warming will bring additional consequences. Resilience-based management and effective interventions at the right scales may buy time for the Reef while global efforts to decrease greenhouse gas are effectively implemented.

Biodiversity



CHAPTER 2

- The condition of coral reefs is now poor (borderline good), reflecting some improvements since 2019, although variability is high at both reef and regional scales.
- Seagrass meadow condition has improved overall, reflecting recovery in northern areas. In contrast, seagrass meadows in the south have continued to decline.
- Knowledge of the condition of mainland beaches and coastlines has improved since 2019, and these habitats remain in good condition.
- Most other habitats are considered to be in good condition, although confidence in grades is limited or inferred.
- Half the species or groups of species assessed are in poor condition.
- Strong concerns continue for certain populations and species of marine turtles and seabirds and for the declining southern populations of dugongs.
- Humpback whale and estuarine crocodile populations have continued to recover following historical reductions to low numbers.

Ecosystem health



CHAPTER 3

- Sixty per cent of 31 assessed ecosystem health components remain in good to very good condition; the remainder are in poor to very poor condition.
- Some physical and chemical processes have continued to deteriorate, due to the continued influence of climate change.
- Ecological processes have generally remained stable, although reef building has continued to deteriorate due to effects of climate change on calcification rates. Trends in recruitment are highly variable between species.
- Vegetation clearing rates in the Catchment have reduced since 2019. The condition of coastal habitats continues to affect their capacity to support the Reef ecosystem.
- Outbreaks of crown-of-thorns starfish are ongoing, but increased control efforts since 2019 have helped reduce the impact of outbreaks on coral habitats.

Heritage values



CHAPTER 4

- Declines in natural heritage values are affecting Indigenous and world heritage values.
- First Nations peoples are increasingly reasserting their role and aspirations in managing Sea Country and protecting Indigenous heritage across the Region.
- Commonwealth historic heritage is in good condition, while other historic heritage is inferred to remain in poor condition.
- The Region's scientific heritage value is increasing. Social values are being maintained with Australian people concerned about the declining condition of the Reef, as their connection to its environment continues to be strong.
- Outstanding universal value remains, but key underpinning components are being increasingly challenged.
- Ecosystem resilience is being challenged and the size of the World Heritage Area is becoming less effective as a buffer to disturbance, particularly against the broadscale impacts of climate change.

Values | Threats, responses, and risks

Commercial and non-commercial use



CHAPTER 5

- COVID-19 restrictions reduced commercial marine tourism, but visitors are now returning.
- Commercial and charter fishing activities reduced due to COVID-19 restrictions, while recreational fishing increased.
- Management of fisheries continues to evolve. Ongoing pressures result from extraction of biomass, interaction of animals with fishing equipment and discarded catch. Illegal fishing and extraction remain a concern.
- Recreational use of the Region remains important to people's identity, and small vessel use is increasing, particularly in inshore areas around major coastal communities.
- Shipping and port trade throughput have declined since 2019 but are expected to return to pre-pandemic levels.
- Ports are an established use, and their presence and ongoing operation continue to pose a range of threats, although some impacts have reduced since 2019.
- Research and monitoring remain critical to effective management of the Region.
- The proportion of the Region's coastline under Traditional Use of Marine Resource Agreements has increased to more than 43 per cent.

Outlook



CHAPTER 10

Long-term outlook for the Region's ecosystems and heritage values

Summary of the findings underpinning the long-term outlook for the Region's ecosystem and heritage values

Factors influencing the Region's values

- Climate change poses the greatest risk to the Region's values, and its effects are projected to become more frequent, severe and widespread.
- Sea temperatures have continued to increase in line with climate change trajectories and mass bleaching events in 2020 and 2022 affected the Reef's ecosystems.
- Coastal development has been relatively minor since 2019, partly due to COVID-19, but projected population growth is likely to increase pressures in coming decades.
- Recent improvements in water quality are reported across inshore areas of the Reef, despite slow progress towards reducing pollutant loads in adjacent catchments. Recovery of some inshore ecosystems, such as seagrass meadows, is linked to improved water quality.
- Changes have occurred in all direct uses (including tourism, recreation and fishing) since 2019 driven by increasing population, the COVID-19 pandemic, market activity and fisheries reforms. Reductions in direct use observed during the pandemic have generally reversed.
- The cumulative effects of climate change and other pressures are increasing the impact on the Region's ecological, heritage, economic and social values.



CHAPTER
6

Existing protection and management

- Management to protect the Region is mostly effective across all six elements of the management cycle when considering the 14 management topics as a group.
- Funding and planning initiatives have been enhanced through the Reef 2050 Plan and the *Queensland Sustainable Fisheries Strategy 2017–2027*.
- Management of threats from climate change remains a challenge despite advances in policy at national, state and local levels.
- Declines in effectiveness of managing research activities, traditional use of marine resources, coastal development and land-based runoff occurred for various reasons, such as recognition of knowledge gaps, lack of integration of Indigenous knowledge, and lag times in achieving outcomes.
- Challenges involved in managing a large and diverse system are significant, and many threats to the Reef are being addressed in meaningful and positive ways.



CHAPTER
7

Resilience

- Some species show continuing recovery from past impacts, but concerns remain for other ecosystem components that have been severely affected by repeated mass bleaching events, heavy floods, crown-of-thorns starfish and marine pollution.
- Recovery of coral cover has been observed in many locations, especially on mid- and outer-shelf reefs. However, recovery of some corals and other reef species has likely been slower, which has implications for resilience.
- Humpback whales have recovered, but their future resilience may depend on impacts from climate change, particularly on food sources outside the Region.
- Coral trout biomass has steadily increased since 2012; however, their resilience is at risk from ongoing cumulative disturbances to coral reef habitat.
- Urban coast dugong populations show an overall long-term decline, with more significant declines detected in southern areas. Their resilience is influenced by climate change and local impacts, particularly to seagrass meadows.
- Loggerhead turtle resilience has been weakened by low levels of juvenile recruitment to foraging grounds, which has declined by half in recent decades.
- The reef tourism industry has shown strong resilience in the face of repeated mass coral bleaching events and the recent COVID-19 pandemic.
- Strong governance and co-management principles that connect First Nations peoples to, and support their agency in, Land and Sea Country management will benefit the resilience of ecosystem and heritage values of the Reef.
- A resilience-based management approach continues to be vital for maintaining the outstanding universal value of the Region.



CHAPTER
8

Risks

- The Region's ecosystem and heritage values remain at very high risk and are projected to face increasing risks in future.
- Overwhelmingly, the threats with the highest risks to the Region are from climate change and its effects.
- Coastal development, land-based runoff and some aspects of direct use (such as illegal fishing and extraction) also present a high risk, although current management measures may decrease risk for certain threats in future.
- Outbreaks of crown-of-thorns starfish remain a serious threat and risk can be reduced through direct interventions.
- Ecosystem and heritage values are closely linked, so in many cases the same threats apply to both sets of values.
- Foundational capacity gaps, fragmentation of cultural knowledge, incompatible uses, illegal activities and other behaviours affect and pose high risks to Indigenous heritage values.
- Community views on risks to the Region's ecosystems and heritage values align with those identified in this assessment.



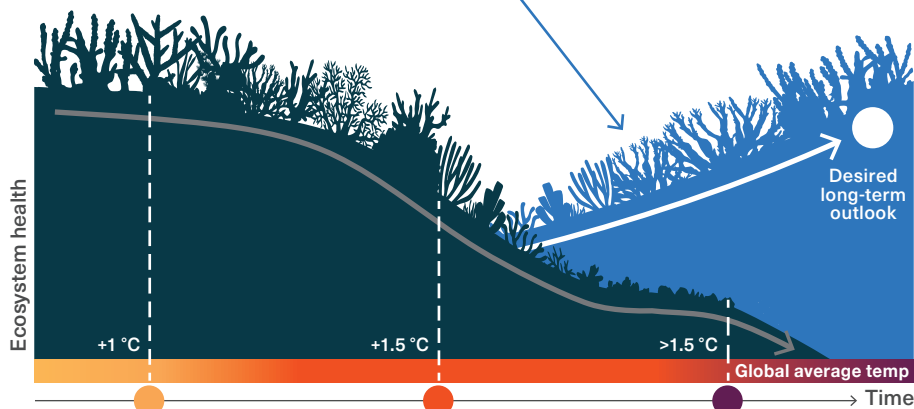
CHAPTER
9

Urgent and effective action on climate change
It is critical that global emissions fall to net zero by mid-century at the latest



Required management actions

- | | |
|---|--|
| <p>Actions in Marine Park</p> <ul style="list-style-type: none"> • Protect the Reef's resilience • Co-manage Sea Country with Traditional Owners • Undertake risk-based spatial planning • Enhance compliance • Undertake effective intervention and rehabilitation | <p>Accelerated actions in Catchment</p> <ul style="list-style-type: none"> • Widespread improved agricultural land management practices • Measurable and timely improvements in water quality • Empower people |
|---|--|



2024 – Current Reef condition	2030 to 2050 – Possible Reef	2050 onwards – Possible Reef
+1 °C above pre-industrial	+1.5 °C above pre-industrial	>1.5 °C above pre-industrial
<ul style="list-style-type: none"> • World heritage values deteriorated • Indigenous heritage and community wellbeing impacts detectable • Less diverse coral reefs and some reef fish declining • Coral bleaching events and other impacts accumulating, and recovery time increasing • Intensifying pressures are slowing seagrass meadow recovery • Warmer temperatures cause more female and fewer male marine turtles • Stable nature-based tourism industry, but in restricted locations as areas recover post-disturbance • Viable fishing industries, but lower catches post-disturbance 	<ul style="list-style-type: none"> • World heritage values significantly deteriorated • Indigenous heritage and community wellbeing impacts significant • Increasing boom and bust of branching and plate corals, loss of large slow-growing corals, increasing rubble • Fewer colourful reef fish • Loss and degradation of some seagrass meadows • Impacts to coastal habitats and coastlines from sea level rise, particularly in estuaries and on low-gradient shores • Marine turtle, seabird, and dugong populations in continued decline • Marine heatwaves increase in frequency, duration, spatial extent and intensity • Unreliable and increasingly extreme weather affects reef use • Fisheries may target different species • Higher disease prevalence across multiple species 	<ul style="list-style-type: none"> • World heritage values not intact • Indigenous heritage and community wellbeing impacts irreversible • Coral reefs replaced with flatter rubble and algal-dominated systems • Significant impacts for reef associated species, including reef fish • Major reductions in seagrass abundance, more frequent and extensive loss events • Mangroves and saltmarsh shift shoreward as sea levels rise; losses due to coastal squeeze • Coastal protection reduced and coast less habitable; more beach erosion • Marine turtles, seabirds, and dugongs in rapid decline • Marine heatwaves 4 to 8 times more likely by the end of the century • Extreme weather events increasingly frequent or intense; impacts on reef use and the Reef • Fisheries may transition to new products and markets (e.g., algae and herbivorous fish) • Increasing incidence of disease

Future pathways for the Great Barrier Reef Region

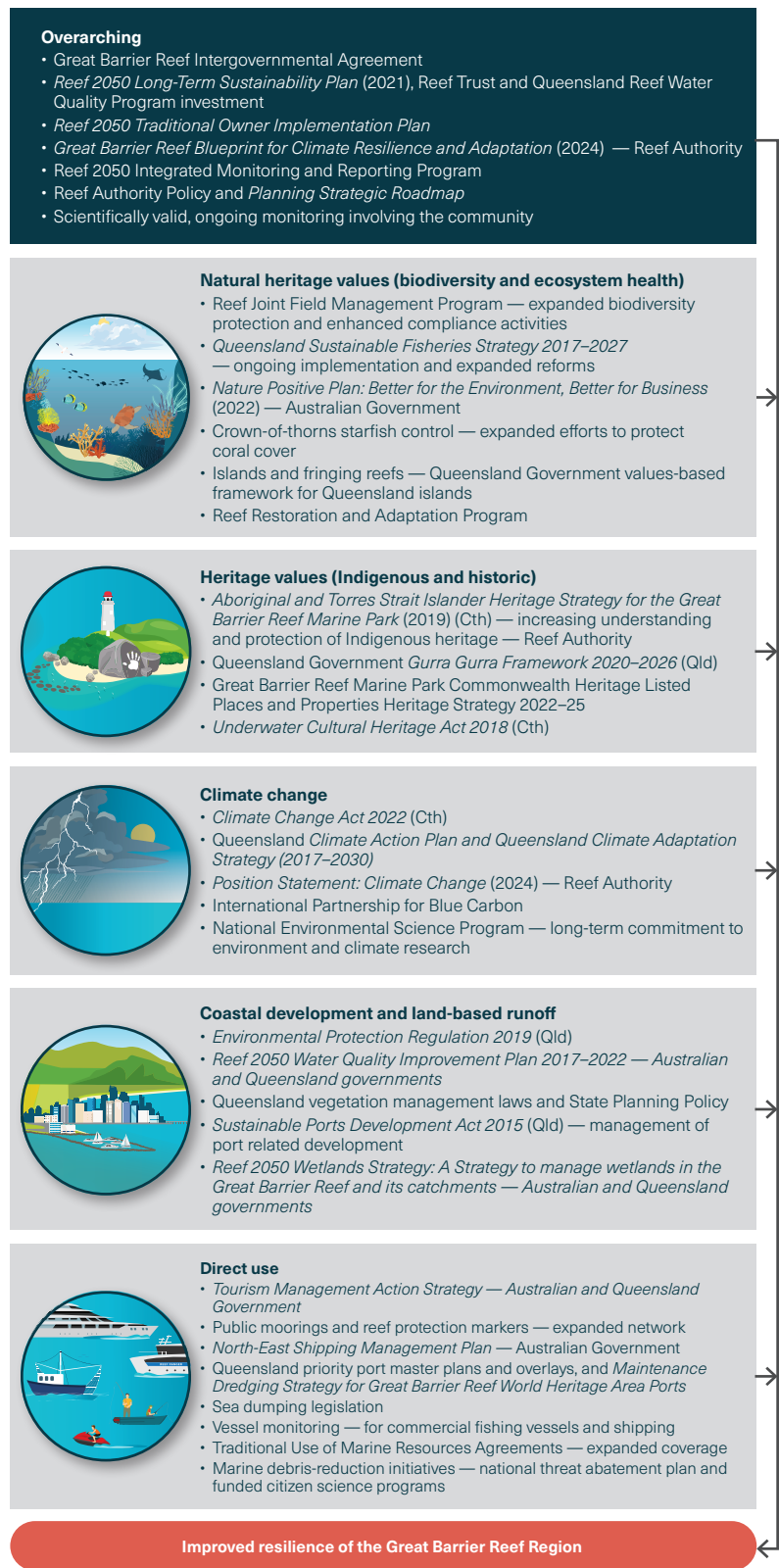
Figure 10.2 in main report: The two outlook pathways shown provide examples of what the future might look like depending on whether key risks are adequately mitigated within required timeframes. The pathways are indicative and based on a large body of evidence from the previous chapters. Mitigating risks requires action on climate change and management actions in the Great Barrier Reef Marine Park and the Catchment. Reef condition and social values have already changed and will continue to change. Some change to the Reef is inevitable, but a more positive outlook pathway is still possible if global, regional and local mitigation and management actions are accelerated and implemented in time.

Across the Region and at local scales, it is imperative that management actions continue to address compounding threats and everything possible is done to create recovery windows for the Reef. The Reef 2050 Plan has continued to drive action across the management of land-based runoff, sustainable fisheries management and crown-of-thorns starfish control. Direct management actions can reduce pressures and localised ecosystem recovery has been observed in some areas, but it is slow.

Multi-agency efforts to explore tangible and scalable reef interventions may lead to a suite of innovative and targeted measures that could provide options for management in the future. The success of these interventions will depend on favourable Reef conditions for growth and recovery, which will not occur unless the rate of anthropogenic climate change is halted and reversed.

It is essential that the management of the Region is adaptive as the extent and seriousness of different risks to the Reef change over time. Difficult choices will need to be met head on and more often. Managers may need to change how some things are done, try new approaches, and let go of some longstanding practices.

The Reef is already a changed system, and communities and industries that depend on it must prepare for continued change. As a social-ecological system, the health of the Reef ecosystem will continue to have both impacts on, and benefits for, the community and human wellbeing (socially, culturally, and economically). Society will need to play a pivotal and urgent role in mitigation and adaptation to support the Region's resilience. The future Reef will be vastly altered by climatic changes that already set in motion, but just as every increment of warming will compound impacts, every effective action taken now contributes to a more positive long-term outlook.



Current and future initiatives to improve the Region's values and support resilience Figure 10.4 in main report.

Summary criteria

Outlook for the ecosystem

Key habitats, species, and ecosystem processes remain healthy or capable of near-term recovery in the absence of acute disturbances. However, the threats affecting the Region's ecosystem (natural heritage values) are increasing, compounding, and expanding in scale. These are driven strongly by climate change and involve steadily increasing chronic threats, such as ocean acidification, as well as a rising probability of acute disturbances, such as marine heatwaves. Multi-jurisdictional solutions and on-ground management involving stakeholders and the community are highly valuable, but outcomes are being undermined by climate change. Current trajectories for global greenhouse gas emissions are not compatible with a healthy and resilient future Reef. The window of opportunity to secure a positive future for the Reef is closing rapidly, and strong, effective actions remain urgent at global to local scales.



Overall risk to heritage values (Indigenous, historic and other heritage values)

Many of the Region's heritage values are closely tied to the condition of the ecosystem. The most serious risks to the Region's heritage values are from climate change, land-based runoff, coastal development, and some aspects of direct use. Identification and monitoring of the broad range of Indigenous, historic, and other heritage values is not yet well established but is improving. Indigenous heritage values are compromised due to the lack of agency and access by First Nations people to manage their Country. Adopting and implementing co-management principles and greater sharing of knowledge of heritage values among the Region's managers, Traditional Owners and stakeholders are critical to ensuring recognition and continued protection of those values.



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