



RISKS TO THE REEF

CHAPTER EIGHT

"The pressures on its future remain heavy, but the counter pressures have proved stronger... Though its brilliant waters have been dulled and darkened here and there by unwise and greedy uses and human and industrial forms of pollution, the Great Barrier Reef is still the closest most people will come to Eden."

Judith Wright, 1996

Poet, author and advocate for the Great Barrier Reef

"an assessment of the risks to the ecosystem..." within the Great Barrier Reef Region, Section 54(3)(d) of the Great Barrier Reef Marine Park Act 1975

8 RISKS TO THE REEF

8.1 Background

Concerns for the Great Barrier Reef's health and wellbeing have highlighted many issues over the past 50 years. Outbreaks of crown-of-thorns starfish, the prospect of drilling for oil and the mining of reef limestone stirred widespread public concern in the 1960s. These threats were largely responsible for government initiatives to focus scientific effort on the Great Barrier Reef as well as to manage it proactively.

In the early 1980s, the priorities for managing the Great Barrier Reef were to address the identified risks arising from the absence of a planning regime, the lack of basic scientific knowledge to underpin management decisions and the lack of management. By the late 1990s, management directions were focused on the critical issues of conservation, water quality, coastal development, fisheries, tourism and recreation.

More recently, the potentially catastrophic risk of climate change was assessed¹ and became a focus of management in 2007.

This assessment addresses the risks that remain to the Great Barrier Reef after considering the effectiveness of existing measures to protect and manage the ecosystem.

8.2 Scoping and assessing current threats

8.2.1 Scoping current threats

In preparing this Outlook Report, opinions and issues regarding potential threats to the Great Barrier Reef ecosystem were gathered from a broad range of sources, including reef scientists, stakeholders, industry partners and the local community. Seventy coral reef scientists participated in an online survey to identify and rank threats. The Great Barrier Reef Marine Park Authority's 11 regionally based Local Marine Advisory Committees and four issues-based

Reef Advisory Committees participated in a more detailed process to identify and rank threats to the ecosystem. Broader community views were gauged through an attitudinal survey.²

All groups expressed similar views on the most serious threats to the Great Barrier Reef ecosystem (table 8.1). Of primary concern were climate change, rural and agricultural development and catchment runoff, urban and industrial development and runoff, and fishing pressure.

The consultation processes with the Local Marine Advisory Committees and Reef Advisory Committees identified more than 400 individual issues; these were consolidated into a final set of 41 threats to the Great Barrier Reef ecosystem (Appendix 3), which are the basis of this assessment. These threats very closely reflect the factors identified in Chapter 5.

The threats that the committees identified relating to management resources and governance are broadly considered in Chapter 6.

8.2.2 Assessing threats

To assess the risks to the Great Barrier Reef ecosystem posed by the 41 threats, the Australian Standard for risk assessment (AS/NZS 4360:2004) was followed. The best available information about the current state of the ecosystem, current use patterns, factors that are influencing the ecosystem, effectiveness of management and current resilience of the ecosystem was used (see Chapters 2-7).

Both the likelihood and consequence of each predicted threat were ranked on a five-point scale (Appendix 4). An overall risk level for each threat was then determined, based on both its likelihood and consequence.

Most stakeholders agree on the major threats to the Great Barrier Reef ecosystem.

Table 8.1 | Community views on the threats facing the Great Barrier Reef ecosystem

A range of groups were surveyed about their perceived threats to the Great Barrier Reef ecosystem. The ranking of these threats was purely on the priority of each risk to the Great Barrier Reef as identified collectively within each group. The responses were very similar, with climate change and rural and agricultural development and catchment runoff viewed as the most significant threats.

Community group	Ranking of perceived risk					
	First	Second	Third	Fourth	Fifth	Sixth
Queensland community	Climate change	Rural and agricultural development and catchment runoff	Fishing pressure	Urban and industrial development and runoff	Too many tourists	Introduction of exotic pests and diseases
Scientific community	Climate change	Rural and agricultural development and catchment runoff	Urban and industrial development and runoff	Fishing pressure	Governance and resources	Broad global and national issues
Local Marine Advisory Committees	Climate change	Rural and agricultural development and catchment runoff	Urban and industrial development and runoff	Governance and resources	Fishing pressure	Introduction of exotic pests and diseases
Reef Advisory Committees	Climate change	Governance and resources	Rural and agricultural development and catchment runoff	Community awareness	Fishing pressure	Boating and recreation

It is important to note that such a risk assessment can only include those threats to the ecosystem that are known and identified. There is likely to be more unknown and unanticipated threats that have not been considered. Hence, the list of threats considered in subsequent Outlook Reports may be different.

Comprehensive risk analysis of an ecosystem the size and complexity of the Great Barrier Reef (recognising that each of the many threats affect the system over different time scales, at different intensities and with widely variable synergistic relationships) would be an undertaking well beyond the scope of this Report. Thus, several important broad assumptions were made to facilitate the assessment provided here:

- Each threat was initially assessed in isolation from others; compounding effects are discussed separately (Section 8.3.4)
- Each threat was assumed to be possible at any geographic location
- Threats were assessed as they are today (for

example, current fishing catch amounts and techniques) or on the basis of documented trends (for example, trends in sea temperature and ocean acidification)

- Threats were assessed with existing, but not any future, management measures in place.

It is important that the results below are interpreted with these assumptions in mind.

8.3 Overall threat to the ecosystem

8.3.1 Most serious threats

The results of the formal risk assessment closely correspond with conclusions presented in earlier chapters of this Report. Based on the outcomes of the risk assessment (figure 8.1), six of the 41 identified threats are a very high risk to the Great Barrier Reef ecosystem and another nine threats are a high risk. A better understanding of the individual threats is gained by linking each of the threats to the factors influencing the Reef's values identified in Chapter 5 (figure 8.2).

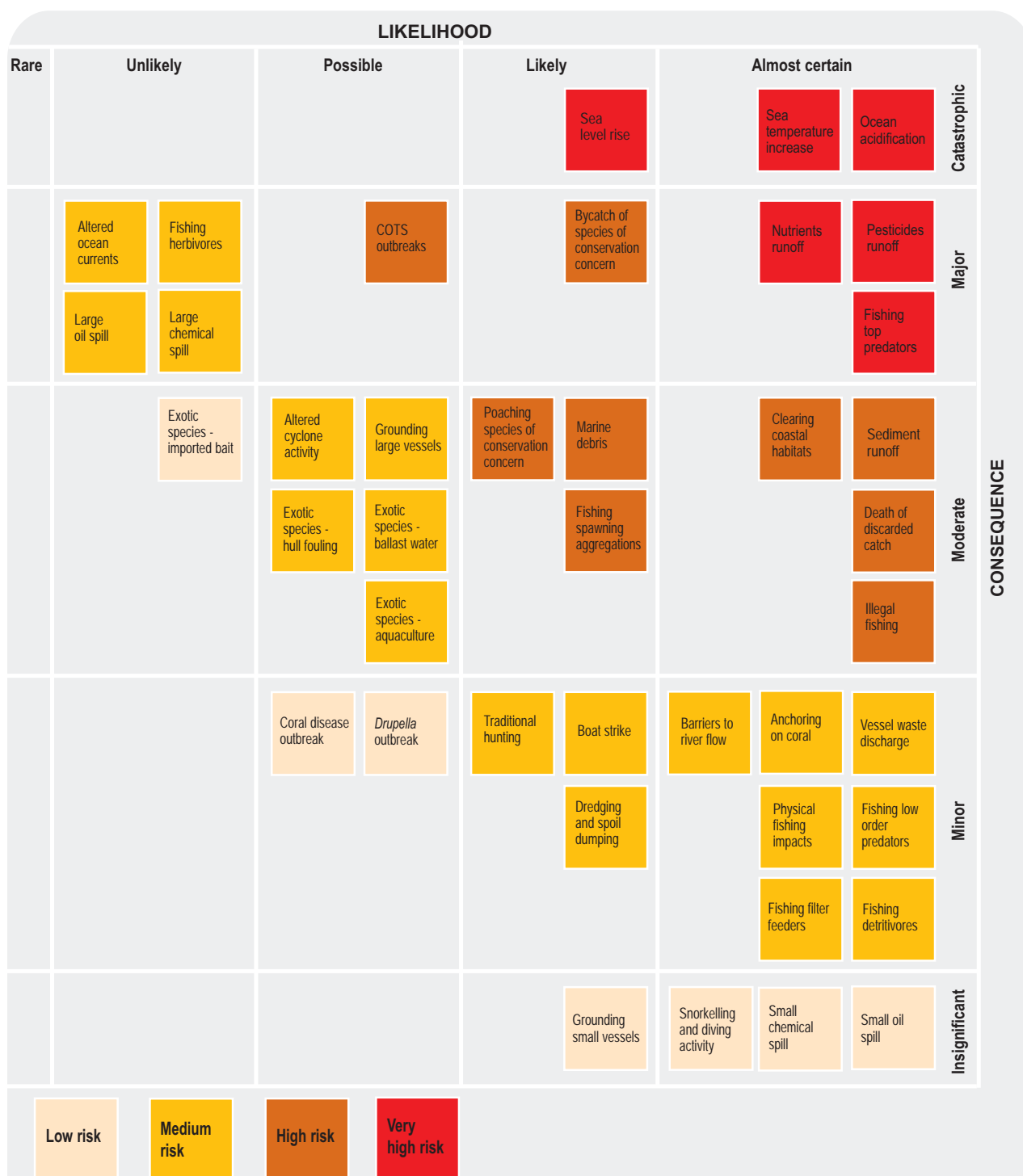


Figure 8.1 Current risks to Great Barrier Reef ecosystem

This risk matrix has been developed in accordance with the Australian Standard (AS/NZS 4360:2004) using terms and definitions detailed in Appendix 4. The assessment is based on current or documented trends in the identified threats and existing management measures. The compounding effects of threats are not considered. The full wording for each of the identified threats is provided in Appendix 3.

The greatest threats to the Great Barrier Reef ecosystem, as identified by the risk assessment (figure 8.1) are:

- **Climate change:** increasing sea temperature, ocean acidification and rising sea level
- **Catchment runoff:** nutrients, pesticides (including herbicides) and sediments entering the Great Barrier Reef
- **Coastal development:** clearing or modifying wetlands, mangroves and other coastal habitats and ingestion of or entanglement in marine debris causing death in species of conservation concern.
- **Direct use – extractive:** extraction of top predators by fishing (e.g. sharks), incidental catch during fishing of species of conservation concern, illegal fishing or collecting (foreign or domestic), death of discarded species during fishing or collecting, fishing in unprotected fish spawning aggregations and poaching (illegal hunting) of species of conservation concern.

The threats associated with direct use of the Great Barrier Reef Region that do not involve extraction of its resources are generally of lower risk to the ecosystem. For example the threats of large oil and chemical spills, grounding of large vessels and anchoring on coral by small vessels are assessed as medium risk. Large oil and chemical spills are considered unlikely to occur because of the management arrangements in place, but could have major consequences on the ecosystem. Threats such as physical impacts of snorkelling and diving activity, small oil and chemical spills, and grounding of small vessels are low risk.

Some threats are driven by more than one factor. For example, the high risk of ingestion of or entanglement in marine debris causing death in species of conservation concern, is affected by coastal development (e.g. the use of plastic bags) and also influenced by direct extractive and non-extractive use of the Great Barrier Reef (e.g. littering whilst at sea).

On a positive note, several threats previously considered high risk are now assessed as low risk due to effective management arrangements (Chapter 6). For example, the physical impacts of fishing are now a medium risk because of the management arrangements for trawling (Section 7.2.2). The risk of damage to corals and other organisms from anchoring, vessel groundings and diving and snorkelling activities has been reduced by improved management of tourism activities, site management and education.

In addition, a management focus on the threats associated with land-based aquaculture beginning earlier this decade has lowered the risks of this activity in the Great Barrier Reef catchment.

Climate change, coastal development, catchment runoff and extractive use are the most serious risks to the Great Barrier Reef ecosystem.



Threat-focussed management measures are significantly reducing the risk to the Great Barrier Reef ecosystem from land-based aquaculture such as this prawn farm near the mouth of the Burdekin River.

Marine tourism - reducing risks and driving conservation

In the early 1980s, tourism numbers to the Great Barrier Reef were increasing by about 30 per cent annually.³ From this time to the early 1990s, tourism was perceived by some as a risk to the very values that make the Great Barrier Reef an iconic destination.

The Great Barrier Reef Marine Park Authority responded to the potential risks of this increasing activity with limits to the number of tourism craft in high use areas; vessel and group size limits; site management arrangements; regulations; and operational policy (such as for moorings, bareboats (self-sail) and cruise ships). Over the last decade, the tourism industry has worked to achieve high standards and make a contribution to management. A clearly articulated common goal of a healthy reef and a healthy industry is now shared by the Great Barrier Reef Marine Park Authority and the tourism industry.

Tourism numbers have been stable since the mid-1990s and the footprint of marine tourism on the Great Barrier Reef is considered to be small and generally localised.⁴ Threats to the Great Barrier Reef ecosystem that could be associated with tourism activities, such as anchoring on coral, physical damage of snorkelling and diving and grounding of small vessels have been significantly reduced and are now considered to be generally low risk to the ecosystem (figure 8.1).

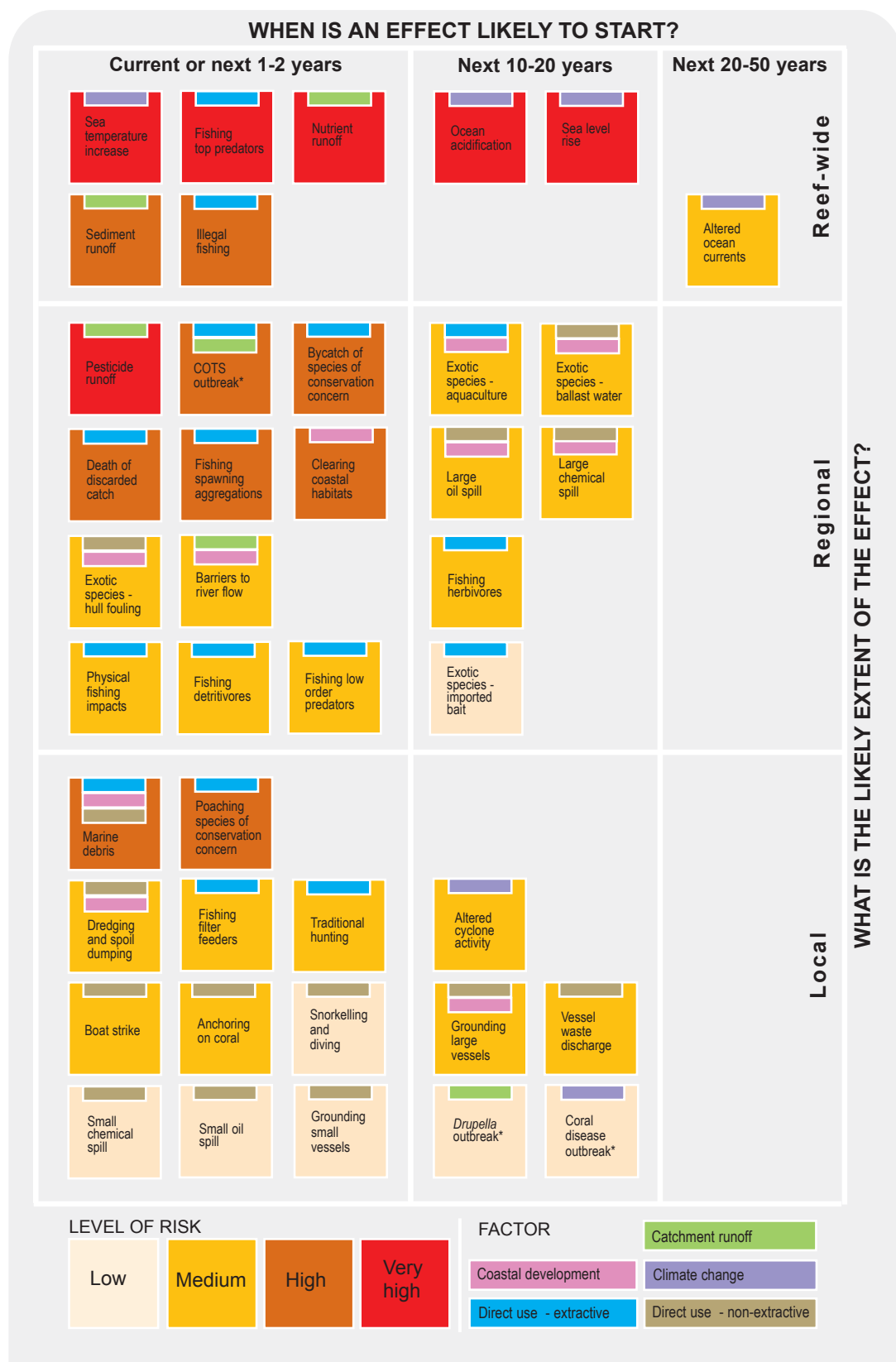


Figure 8.2 Extent and timing of threats and their driving factors

Climate change and catchment runoff are driving most of the very high risk threats to the ecosystem. Most of the threats that present a very high risk to the Great Barrier Reef ecosystem are already having an effect (left hand column) or are expected to in the next 10-20 years (middle column). In addition, the threats assessed as very high risk are expected to have an effect Reef-wide (top row). Those threats for which the factors are not clearly known are marked with an asterisk (*).

Reducing the risks of land-based aquaculture

Potential threats associated with land-based aquaculture adjacent to the Great Barrier Reef Marine Park include nutrients and sediments from catchment runoff, clearing or modifying coastal habitats and the introduction of exotic pests and diseases.

Since the introduction of the *Great Barrier Reef Marine Park (Aquaculture) Regulations 2000*, there has been a significant improvement in the environmental performance of land-based aquaculture facilities. These Regulations directly regulate land-based pollutant inputs to the Marine Park. At the same time, collaboration between the Australian and Queensland Governments and industry has led to the development of operational policies that articulate minimum standards for environmental sustainability.

8.3.2 Scale and timing of threats

The identified threats to the Great Barrier Reef are highly variable in both timeframe and the scale of impact (figure 8.2). Some of the threats identified as highest risk are impacting the ecosystem at a Reef-wide scale and are happening now (for example, the very high risk threats of sea temperature increase and nutrients from catchment runoff). Significantly, a majority of the threats considered in this assessment are already affecting the ecosystem or are likely to do so in the next few years. Of the very high risk threats, ocean acidification and sea level rise are predicted to show major impacts over a longer time frame (within 10 to 20 years, refer Section 5.2), although their effects are already beginning to be documented.

Ultimately, the extent and timing of many of these threats will be determined by overarching drivers of change such as global concentrations of greenhouse gases, population growth (both in the catchment and globally) and global economic conditions. These drivers are well beyond the management control of agencies responsible for protecting and managing the Great Barrier Reef ecosystem.

Community attitude is an important catalyst for change. In a 2007 survey, members of communities along the Great Barrier Reef coast and in Brisbane, Sydney and Melbourne overwhelmingly considered that the general community had a role to play in looking after the Great Barrier Reef (97 per cent

for coastal areas and 91 per cent for southern capitals).⁵

8.3.3 Origin and existing management of threats

The effectiveness of existing protection and management is outlined in Chapter 6. For the factors of climate change (Section 6.2.2), catchment runoff (Section 6.2.12) and coastal development (Section 6.2.3), the origins of the threats are outside the Great Barrier Reef Region (either global or within the Great Barrier Reef catchment). Management of these factors was independently assessed as some of the weakest of all the management topics considered, especially in terms of outcomes (figure 8.3).

The threats associated with extractive use (such as from fishing, some traditional use, some scientific research) originate from within the Great Barrier Reef Region. Like the other high risk factors; existing management of these factors was independently assessed as amongst the weakest, especially in terms of outcomes (for fishing) and financial, staffing and information inputs (for fishing and traditional use). Direct use of the Great Barrier Reef Region that is not extractive (i.e. commercial marine tourism, defence activities, shipping, recreation (not including fishing), some scientific research and some traditional use) is generally more effectively managed and is assessed as a lower risk to the ecosystem.

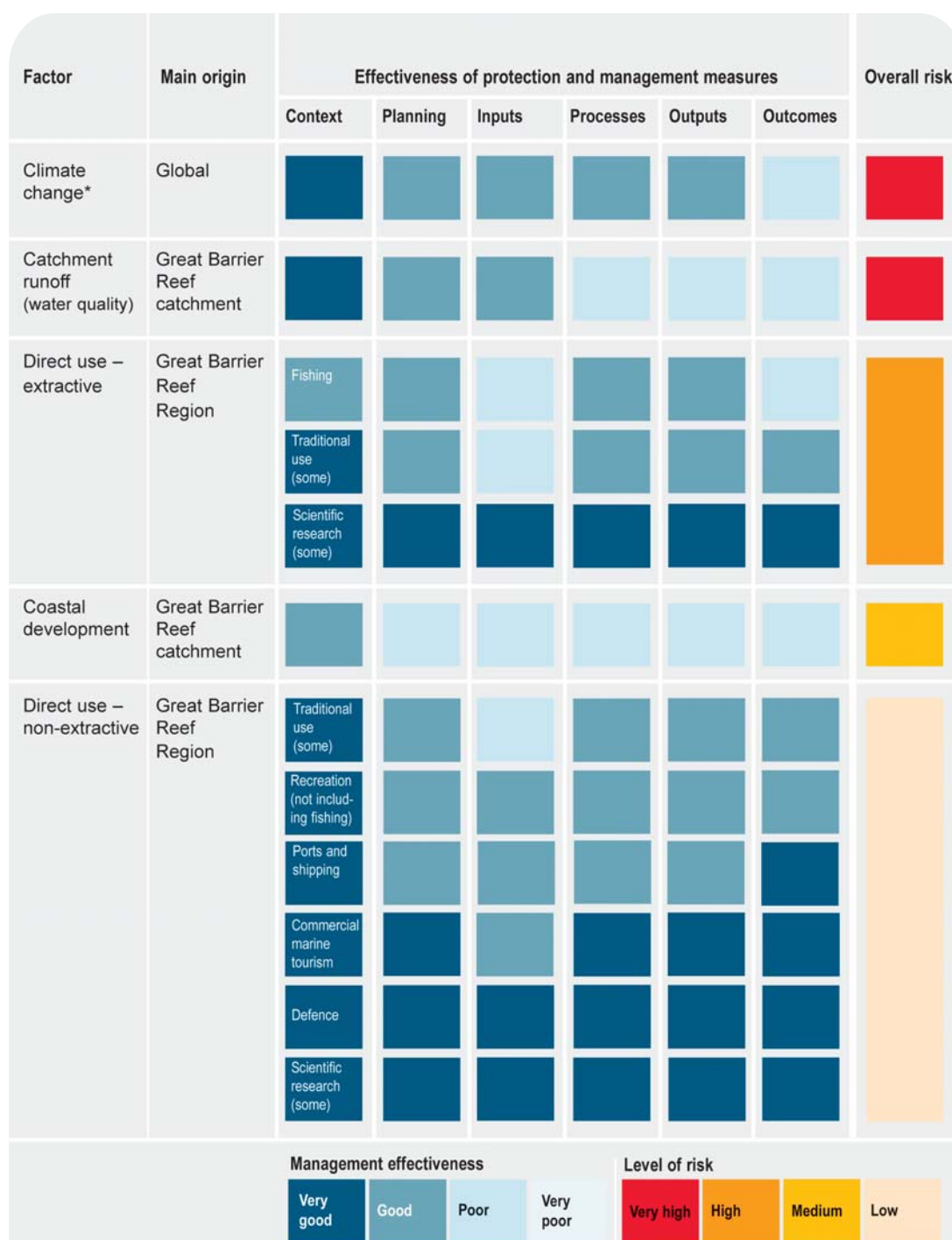


Figure 8.3 Effectiveness of existing management for identified risk factors

Except for direct extractive use of the ecosystem, the factors that present the highest overall risk to the Great Barrier Reef ecosystem have their origins outside the Great Barrier Reef Region. The effectiveness of management for the four highest risk factors are some of the weakest of the management topics assessed in an independent assessment (based on the six elements: understanding of context; planning; financial, staffing and information inputs; management systems and processes; delivery of outputs and achievement of outcomes). Refer to Chapter 6 for a full discussion of the effectiveness of existing management. (*) The assessment of management effectiveness for the topic of climate change is only in relation to management measures undertaken specifically to protect and manage the Great Barrier Reef.



Big-eyed trevally

8.3.4 Interactions and compounding effects

None of the threats to the Great Barrier Reef ecosystem operate in isolation from one another. Each is present at the same time and affecting the same ecosystem. As a result, the Great Barrier Reef's natural values are under severe pressure and the ecosystem's resilience to each threat is significantly compromised by the presence of other threats.

Many of the threats also have a synergistic effect, where the impact of two or more threats acting together is much worse than that expected from the sum of their individual impacts. Although the detail of such compounding effects is beyond the scope of this Report, they are likely to dominate much of the future outlook for the Great Barrier Reef (Chapter 9). For example, a coral's ability to recover from bleaching resulting from a rise in sea temperature is much reduced if it is living in degraded water where ecological processes have been compromised.⁶

Each of the above conditions will be exacerbated further by predicted effects of climate change: more frequent events (mass bleaching, severe cyclones and runoff), compromised growth rates or skeletal strength (ocean acidification) and disease outbreaks. Even small changes in a range of key physical, chemical or ecological processes may result in sudden widespread deteriorations on a scale not observed previously - which would in turn reduce even further the resilience of the ecosystem.

The risk presented by each individual threat is compounded and sometimes magnified by the other threats.

8.4 Assessment summary – Risks to the Reef

Section 54(3)(d) of the *Great Barrier Reef Marine Park Act 1975* requires "...an assessment of the risks to the ecosystem..." within the Great Barrier Reef Region. This assessment is based on the current state and trends of the Great Barrier Reef ecosystem's biodiversity and health, the factors influencing the values of the Region, the effectiveness of protection and management arrangements and ultimately an understanding of the ecosystem's overall resilience.

8.4.1 Overall threat to the ecosystem

Assessment components	Summary	Assessment Grade			
		Low risk	Medium risk	High risk	Very high risk
Climate change	The threats of increasing sea temperature, ocean acidification and sea level rise are very high risks to the ecosystem.				○
Catchment runoff	The threats of nutrients, pesticides and sediments from catchment runoff are high and very high risks to the ecosystem.			○	
Coastal development	Clearing of coastal habitats is a high risk to the ecosystem, as is the threat of ingestion of marine debris by species of conservation concern.			○	
Direct use – extractive	There are a number of threats associated with fishing and traditional use. Extraction of top predators is a very high risk to the ecosystem, others are of either high (such as illegal fishing) or medium risk.			○	
Direct use – non-extractive	There are a number of threats from non-extractive use, generally of low to medium risk. Large chemical and oil spills, although unlikely, could be of major consequence.		●		
Overall threat to ecosystem	The ecosystem is at serious risk from the compounding impacts of climate change, catchment runoff, coastal development and extractive use. Of the many other threats to the Great Barrier Reef ecosystem, most present a small risk individually, but combine to further reduce ecosystem resilience. Other threats are effectively managed and are now assessed as a much reduced risk.			○	
GRADING STATEMENTS	Low risk - Given current management arrangements, any threats considered likely or certain to occur are predicted to have no more than insignificant consequences for the ecosystem. There may be minor or moderate consequences for the Region's ecosystem for other less likely threats.				
	Medium risk - Given current management arrangements, few of the threats considered likely or certain to occur are predicted to have moderate consequences for the Region's ecosystem and none will have catastrophic consequences. Some unlikely threats may have major consequences for the Region's ecosystem.				
	High risk - Given current management arrangements, many of the likely or almost certain threats are predicted to have moderate or major consequences for the Region's ecosystem.				
	Very high risk - Given current management arrangements, there are likely or almost certain threats that are predicted to have catastrophic consequences on the Region's ecosystem.				

8.4.2 Overall summary of risks to the Reef

This risk assessment combines the knowledge presented in earlier chapters of the Report to provide an assessment of current and potential threats to the Great Barrier Reef and is an important step in predicting the future of the ecosystem.

The greatest threats facing the Great Barrier Reef ecosystem are from climate change. The individual threats of increasing sea temperature, ocean acidification and rising sea level are assessed as very high risk to the ecosystem and they will act across the entire Region. Their impact will be compounded by each other and by other existing regional and local threats.

The most serious, regional-scale risks are catchment runoff, coastal development and some aspects of extractive use. These threats have the potential to work in combination to weaken the resilience of the Great Barrier Reef and therefore its ability to recover from serious disturbances (such as major coral bleaching events) that will become more frequent in the future.

While climate change will affect all parts of the Great Barrier Reef, the compounding effects of threats associated of catchment runoff, coastal development and some extractive use means that the nearshore environment next to developed areas is the most at risk.

References

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