



## Worth a look:

**Great Barrier Reef Climate Change Action Plan 2007-2012**

[www.gbrmpa.gov.au/corp\\_site/key\\_issues/climate\\_change/management\\_responses](http://www.gbrmpa.gov.au/corp_site/key_issues/climate_change/management_responses)

**Great Barrier Reef Tourism Climate Change Action Strategy 2009-2012**

[www.gbrmpa.gov.au/corp\\_site/key\\_issues/tourism/climate\\_change\\_and\\_tourism\\_operators](http://www.gbrmpa.gov.au/corp_site/key_issues/tourism/climate_change_and_tourism_operators)

**Great Barrier Reef Outlook Report 2009**

[www.gbrmpa.gov.au/corp\\_site/about\\_us/great\\_barrier\\_reef\\_outlook\\_report](http://www.gbrmpa.gov.au/corp_site/about_us/great_barrier_reef_outlook_report)

**Carbon emission calculator for tourism operators**

[www.emissionscalculator.gbrmpa.gov.au](http://www.emissionscalculator.gbrmpa.gov.au)

**Carbon footprint calculator for individuals**

[www.wwf.org.au/footprint/calculator/](http://www.wwf.org.au/footprint/calculator/)

**Sustainability home**

[www.bunnings.com.au/sustainability\\_home.aspx](http://www.bunnings.com.au/sustainability_home.aspx)

- Ask your energy provider to switch appliances to low-tariff energy (this also saves money)
- Dry clothes the natural way, not in the dryer
- Use less hot water
- Drive less – car pool, use public transport, walk, ride or cycle
- Plant trees – they take up carbon dioxide as they grow
- Purchase wisely – be sure to choose the most climate friendly products.
- When booking flights purchase carbon offsets
- AND most importantly spread the word to others so we can all help protect the reefs of the world.

## The heat is on for the Reef – which future will we choose?

If climate change continues at the current rate, the Reef will change. Scientists predict that under a worst case scenario, reefs could become dominated by algae as opposed to coral, and reef dependent species such as reef fishes will become less

abundant. Adopting a sustainable lifestyle will not only help the Reef, it will also help to improve health, save money, support local economies and leave a healthy planet for our children and grandchildren.

## Confessions of a Reef Guide

With all the debates going on about climate change, people are wondering how to separate myths from facts. So what kind of questions are passengers likely to ask and what kind of answers can you give them?

Here are a few examples from interpretation specialist, Emily Smart,



Fantasea Foundation's Marine Research Coordinator. "Guests often ask: 'Why is there no colour? Why is the coral dead? It's not as colourful as I thought it'd be.' They think that all corals should be bright colours. I explain that 80 per cent of corals are naturally brown and that when photos are taken, it's usually at night when the tentacles are out and it's more colourful."

"If people ask 'how can I help save the Reef?' I encourage them to reduce their carbon footprint."

"I hope to get more and more guests involved in coral watch activities – at this stage the kids appear to be more interested in participating than their parents. It's a little difficult to get people involved because they're on holidays."



Australian Government

Great Barrier Reef  
Marine Park Authority

# Reef Facts

## FOR TOUR GUIDES

ISSUE 3  
Revision 1

## Climate change and the Great Barrier Reef

### The real sea change

Climate change poses one of the greatest threats to coral reefs worldwide. The Great Barrier Reef (the Reef) is one of the largest and healthiest reef systems in the world. While it can cope with stress better than most reefs, it is not immune to the impacts of climate change.

Signs of a changing climate are already evident on the Reef. Sea temperatures increased by 0.4°C between 1871 and 2005 and are predicted to increase 1.1–1.2°C by 2050.

### Corals in hot water

*When the going gets tough... the algae get going.*

While warmer water might be nice for swimmers, it is bad news for corals. Most corals live in partnership with single-celled algae (zooxanthellae). Corals are animals that provide protection and nutrients for the algae, and in return, the algae produce food for the coral and give it colour.

When temperatures get too warm, corals become stressed and the tiny

algae move out. When the algae leave, the coral 'bleaches' and its white skeleton becomes visible.

When many corals in an area bleach, this is called 'mass' coral bleaching. Increased frequency of mass coral bleaching is expected as temperatures rise.

A temperature increase of only 1.5-2°C lasting for six to eight weeks is enough to trigger mass bleaching.

When warm conditions do not persist for long, the algae return and the corals can recover. However, in extreme

## Coral bleaching on the rise: A timely reminder



The world's coral reefs are often compared to canaries in coal mines because they have issued some of the earliest and most visually dramatic warning signs of climate change.

1970 - Until 1979, only three mass coral bleaching events had been recorded worldwide.

1980 - Worldwide, at least 60 mass bleaching events occurred between 1980 and 1993 (Glynn, 1993)

1990 - When sea surface temperatures rose by a few degrees in 1998, 16% of the world's corals were adversely affected.

2000 - More than 400 events were recorded in 2002 alone (UNEP).

2010 - Mass bleaching has now affected every coral reef region in the world.

Your contributions, ideas and feedback are welcome. Please email the GBRMPA at: [tourec@gbrmpa.gov.au](mailto:tourec@gbrmpa.gov.au)

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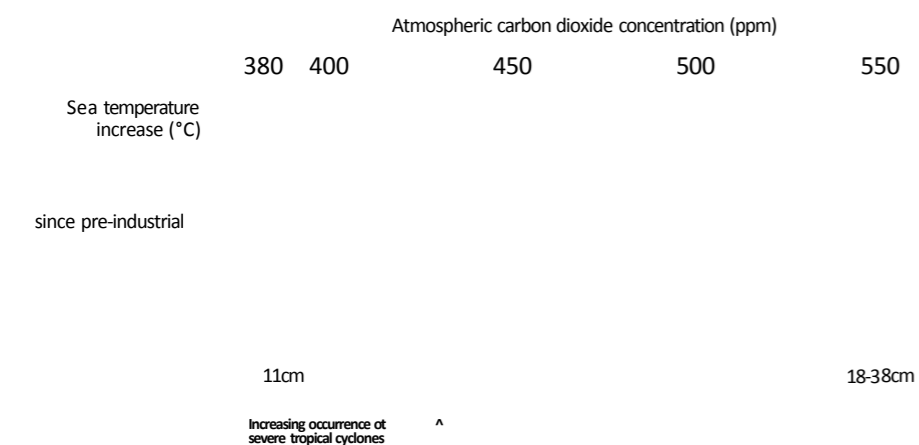
events, when temperatures are high for long periods of time (eight to twelve weeks) corals will die. Recovery of severely damaged reefs can take decades. There have been a number of mass bleaching events on the Reef since 1979. The most severe mass bleaching events occurred in 1998 and 2002.

## Ocean acidification

Our oceans act like giant sponges, absorbing about 30 per cent of the carbon dioxide (CO<sub>2</sub>) in the atmosphere. As oceans absorb more CO<sub>2</sub>, the pH of the seawater decreases and the level of acidity increases. In the last century, the pH of the ocean has decreased by 0.1 units. Increasing acidity in the ocean means the concentration of calcium carbonate is reduced which affects the ability for corals to build the structural framework of reefs and for marine species such as shellfish, sea urchins, starfish and phytoplankton to form shells.

## Rising sea level

The sea level in the Reef region has already risen by about 3 mm a year since 1991 and is continuing to rise. This is a threat to islands and cays that



ppm: parts per million

(Adapted from Hoegh-Guldberg et al (2007). Science: 318)

are important for nesting seabirds and marine turtles. It also affects industries and communities in coastal and low lying areas.

## Changing weather patterns

Current patterns of tropical cyclones around the world indicate an increase in frequency of severe tropical cyclones. Within Australia, although the number of cyclones was lower during the period 1970 to 1997, there was an increase in their severity. In 2009, one of the most severe cyclones ever recorded, Cyclone Hamish, caused extensive damage to the southern part of the Reef.

## Taking the pressure off

*The future of the Great Barrier Reef is in our hands.*

Healthy reefs are more resilient and recover faster from bleaching. Ensuring that the Reef is as healthy as possible will help the Reef cope with a changing climate.

Reefs facing additional pressures, such as declining water quality, overfishing

or extensive damage from anchoring, will be less resilient and will take much longer to bounce back following coral bleaching events.

## What is the Great Barrier Reef Marine Park Authority doing to help?

We are working to help make the Reef as resilient as possible. This means reducing all pressures on the Reef.

We work with state and local governments, industries and communities to:

- Implement the *Great Barrier Reef Climate Change Action Plan 2007-2012*
- Improve the quality of water that flows from our rivers and streams out to the Reef
- Enforce Marine Park zoning which is designed to protect a diversity of habitats
- Predict, monitor and map coral bleaching and sea-surface temperatures in the Marine Park
- Provide public moorings and establish no anchoring areas.

## What are tourism operators doing to help?

A healthy Reef means a healthy tourism industry. Tourism industry leaders and protected area managers have worked in partnership to develop the *Great Barrier Reef Marine Tourism Climate Change Action Strategy 2009-2012* (the Strategy). The Strategy outlines actions the tourism industry can take to help improve reef health and reduce the impacts of climate change. It also

acts as a framework for management actions and provides guidelines to help the tourism industry prepare for and adapt to climate change.

You, like other operators, may already be working hard to implement the Strategy by:

- Reducing energy use
- Recycling
- Switching to alternative fuels
- Offsetting emissions
- Participating in coral reef health

## Telling the story

As awareness of climate change spreads throughout the world, many visitors now come to the Reef with questions on climate change. It is important as a guide to be able to answer these questions in a balanced manner.

### FACTS

Coral bleaching: Mass bleaching has affected every coral reef region in the world. Bleached corals can recover if temperatures return to normal within six to eight weeks. Because healthy corals are more likely to recover from bleaching, it is important to reduce other causes of stress to corals.-FACT

Rising temperatures: Over the last 100 years, the average temperature of the earth's surface has risen by 0.6°C and the average water temperature of the Reef has increased by 0.4°C. Historically, similar changes would have taken thousands of years. - FACT (*Source: The Department of Climate Change*)

Ocean acidification: Chemical changes in the ocean have already decreased oceanic pH by 0.1 units and a 14.2 per cent decline in calcification has been observed in at least one coral species, *Porites*, - FACT

Sea level rise: From 1950 - 2000, global average sea level rise was between 1 and 2 mm per year. Since 1991, the rate of sea level rise on the Reef has increased to about 3 mm per year. - FACT

By 2050, sea level is PREDICTED to rise 10 cm to 40 cm above current levels.

Ocean circulation: Differences in seawater density, which depend on temperature and salinity, drive global ocean currents. - FACT

It is PREDICTED ocean circulation may be slowed by global warming and could change the availability of food sources for animals and birds.

Current health: The Reef is one of the largest, most pristine and best protected reef systems in the world. - FACT (*Source: Pandolfi et al (2003) Science 955-958*)

monitoring programs such as *Eye on the Reef* and *BleachWatch*.

## What can your guests do to help?

Everyone can do their bit to help protect the Reef (no matter where they live). By reducing their carbon footprints, individuals help reduce the impact of climate change on the Reef and protect the amazing environment they are here to enjoy. Here are some

ideas you can share with your guests so they can help be part of the solution:

- Reduce, re-use and recycle
- Switch to 'green electricity' produced from renewable sources
- Use energy efficient lights and turn off lights and electrical devices around your home or business - at the switch is best!
- Heat and cool houses naturally using ventilation and insulation

(continued overleaf...)

### HOW TO TELL THE STORY

*Point out similarities...*

When corals are stressed by heat, the tiny food producing algae that live inside the coral tissue will move out and the coral's white skeleton becomes visible (bleaching). Like humans, if corals are resilient (healthy and fit), they are more likely to recover from this stress.

*Talk about animals people are familiar with...*

Increased temperatures put stress on coral reefs around the world. Many plants and animals are also affected. The gender of turtle hatchlings is determined by air temperature with higher temperatures leading to more female hatchlings.

*Talk about the consequences...*

Acidity of the ocean increases as its pH level decreases. A small increase in acidity reduces the concentration of calcium carbonate making it harder for corals to build their hard supportive skeletons, and for coralline algae to grow and cement the structural framework of the Reef.

*Point out what will be affected...*

Rising sea levels will have an impact on coastal communities and infrastructure. It will also impact the coastal habitats such as seagrass meadows and mangroves which provide nursery grounds for many fish species and may inundate coral cays used for marine turtle nesting.

*Point out relationships...*

Mass mortalities of seabirds and their chicks have already been observed on the Reef because parents had to travel too far to find fish. The changing ocean circulation patterns could have altered the location and depth of cool water preferred by these fish.

*Puf it into perspective...*

The Reef has the world's best practice management and protection. While the Reef is not immune to climate change, your actions enable the Reef to better cope.