

# Coral reefs, key ecosystems facing the challenge of global change

Des océans sains pour une vie meilleure - Genève 9 juin 2016



Denis Allemand



## Coral Reefs: The largest bio-constructions on the planet



Great Barrier Reef (Australia)

2 600 km - surface 344 400 km<sup>2</sup>



Récif barrière de Nouvelle-Calédonie

1 600 km - Surface du lagon 24 000 km<sup>2</sup>



## Biological and economical importance of coral reefs



Coastal protection

Total reef area:  
300,000 km<sup>2</sup>  
0,1% of sea surface area  
BUT  
30% of total known  
marine biodiversity



Food

Ecosystem services

30 milliards \$/an

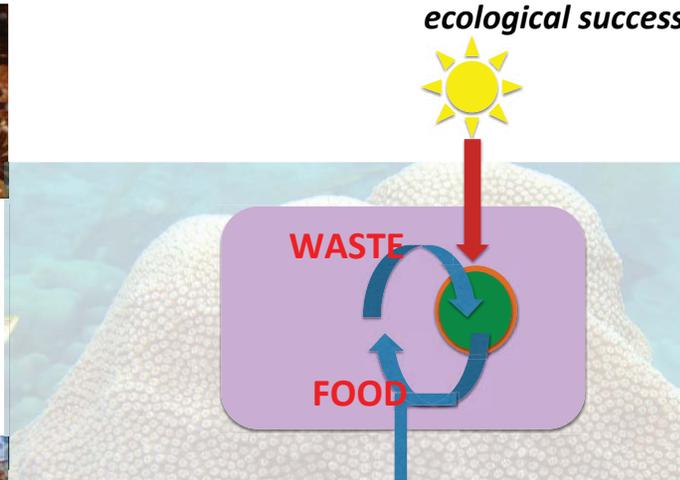
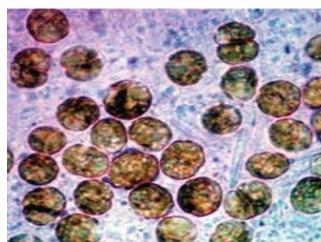
500 million people dependent on reefs for their survival (8% of the World population)



Tourism

## Coral reefs, rain forests of the sea

Symbiosis between an animal and microalgae is the key to this ecological success

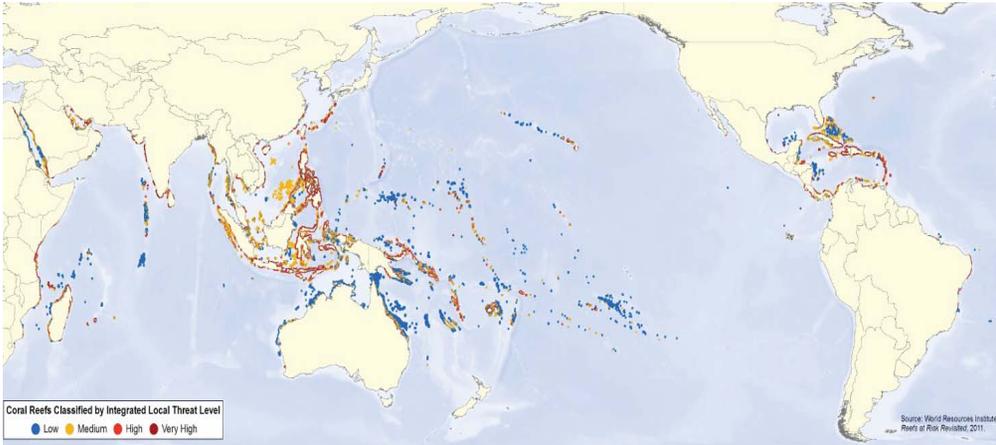


1 million zoox / cm<sup>2</sup> of animal tissue



**Valuable, but vulnerable**

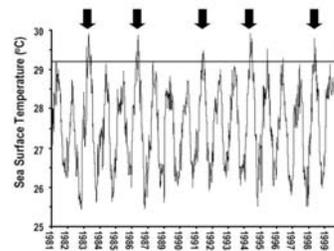
**TO DATE:**  
**20% of coral reefs already destroyed**  
**15% of coral reefs under threat within 10 years**  
**20% of coral reefs under threat within 40 years**



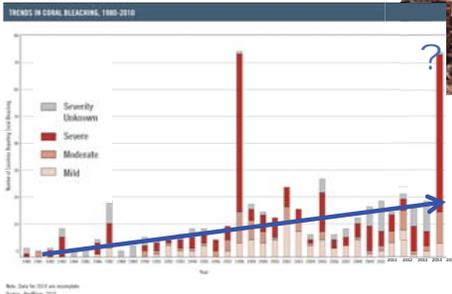
**GLOBAL THREATS: Coral bleaching, the divorce!**

The most sensitive process to global warming

Coral bleaching and thermal stress

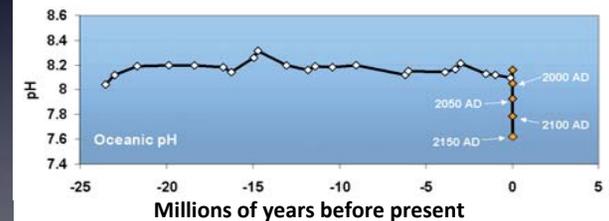
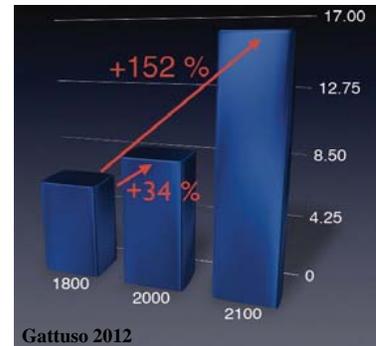
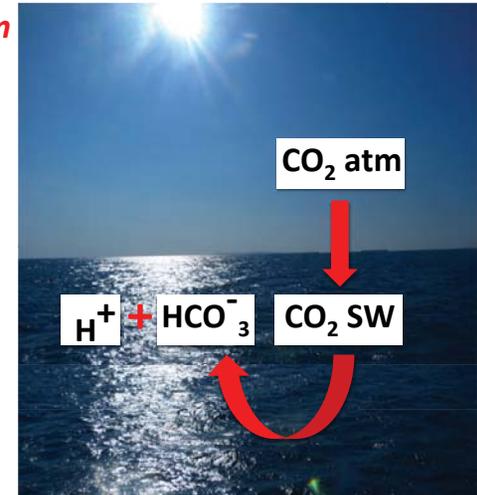
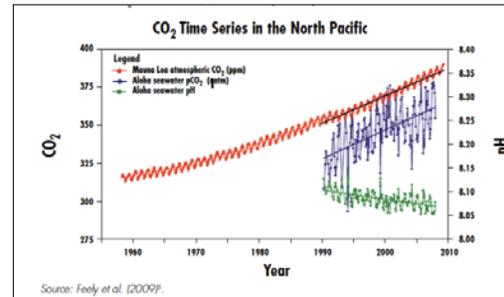


Source : Hoegh-Guldberg & Salvat 1994



- A process that appeared in the eighties and still increasing.
- A process that affects thousand-year-old colonies.
- 20% of coral reefs already lost.

**Global threats: Ocean Acidification**  
 The other CO<sub>2</sub> problem



# Global threats: Ocean Acidification

## The other CO<sub>2</sub> problem



### Losers and winners in coral reefs acclimatized to elevated carbon dioxide concentrations

Katharina E. Fabricius<sup>1\*</sup>, Chris Langdon<sup>2</sup>, Sven Utthick<sup>3</sup>, Craig Humphrey<sup>2</sup>, Sam Noonan<sup>1</sup>, Glenn De'ath<sup>1</sup>, Remy Okazaki<sup>1</sup>, Nancy Muehlethner<sup>2</sup>, Martin S. Glas<sup>1</sup> and Janice M. Lough<sup>1</sup>

Even if some coral species are tolerant, the reef and its complexity will disappear

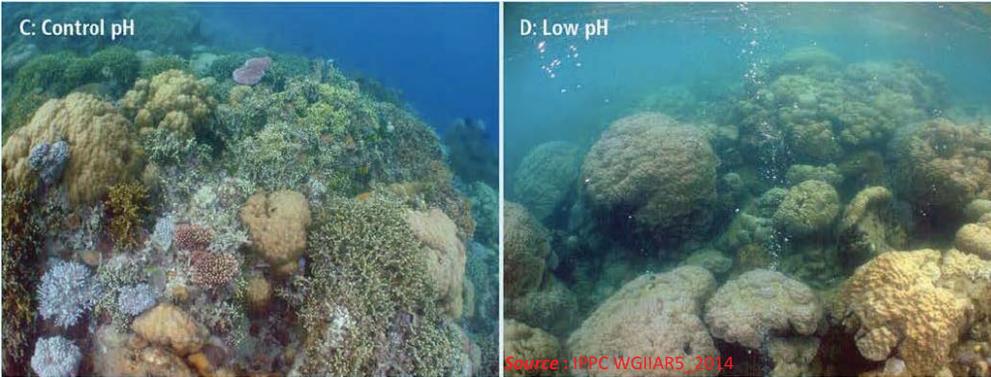
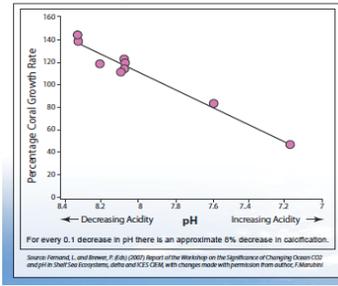


Figure 2: Tropical Coral Calcification (growth rate) Decreases as Acidity Increases



# The Great Barrier Reef: a dark future?

## Local threats



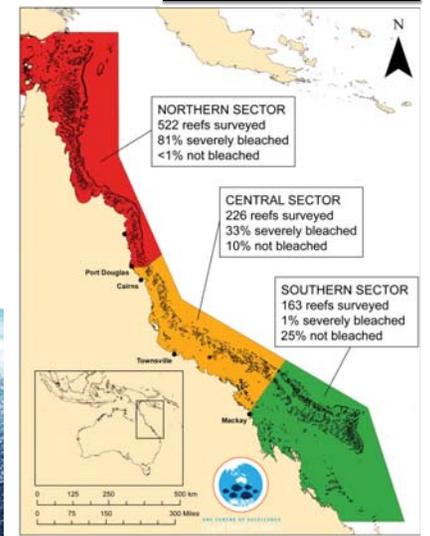
Agricultural run-off (Queensland)

## Overfishing



Nathan Laughton, Australia

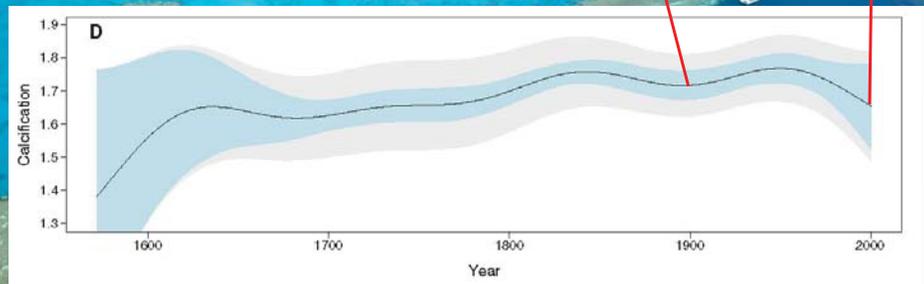
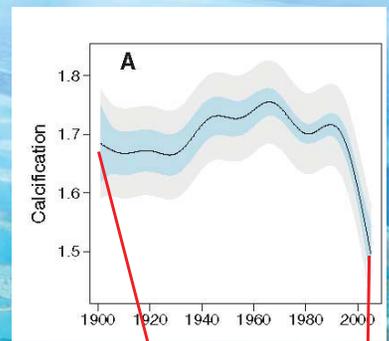
## Global threats



Only 7% of the Great Barrier Reef has avoided coral bleaching

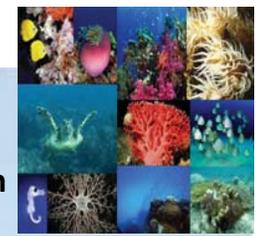
## Declining Coral Calcification on the Great Barrier Reef

Glenn De'ath, Janice M. Lough, Katharina E. Fabricius  
2 JANUARY 2009 VOL 323 SCIENCE www.sciencemag.org



## Coral reefs facing the challenge of ocean warming and acidification

### Conclusions – Take-home messages



1. Coral Reefs are key marine ecosystems with both ecological and socio-economic importance
2. The impact of global changes on coral reefs are already visible
3. The effects of the different stressors are often synergistic
4. Local solutions (eg development of MPAs) are possible but not sufficient
5. The only long-term solution remains a strong reduction of CO<sub>2</sub> emissions to no more than 450 ppm in the atmosphere and a careful management

**Thank you for  
your attention**

